

# Broadband Consultation Prep Workshop

*State of Arizona*

DHS Office of Emergency  
Communications

January 28, 2013



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# Today's Agenda

## **I. OEC Background and Public Safety Broadband Overview**

- I. OEC Technical Assistance
- II. Nationwide Public Safety Broadband Network (NPSBN) & FirstNet
- III. State and Local Implementation Grant Program (SLIGP)

## **II. Establishing Coverage Objectives**

- I. State Overview
- II. Review OEC Baseline
- III. Tailoring based on State's Needs

## **III. Identifying Users**

- I. Eligible Users
- II. User Identification
- III. Data Collection Tools

# Acronym List

3GPP	Third Generation Partnership	NECP	National Emergency Communications Plan
BSA	Baseline State Analysis	NGO	Non Governmental Organization
CASM	Communications Asset and Survey Mapping	NPSBN	National Public Safety Broadband Network
CDP	Census Designated Place	NPSTC	National Public Safety Telecommunications Council
ECPC	Emergency Communications Preparedness Center	NTIA	National Telecommunications & Information Agency
EPC	Evolved Packet Core or "Core"	OEC	Office of Emergency Communications
FirstNet	First Responder Network Authority	PSAC	Public Safety Advisory Council
GIS	Geographical Information System	PTT	Push To Talk
GoS	Grade of Service	RAN	Radio Access Network
ICTAP	Interoperable Communications Technical Assistance Program	SCIP	Statewide Communications Interoperability Plan
LMR	Land Mobile Radio	SLIGP	State and Local Implementation Grant Program
LTE	Long Term Evolution	SOP	Standard Operating Procedure
MDST	Mobile Data Survey Tool	TA	Technical Assistance
MOU	Memorandum of Understanding	TICP	Tactical Interoperable Communications Plan
NCS	National Communications System	UE	User Equipment
		VOIP	Voice Over Internet Protocol



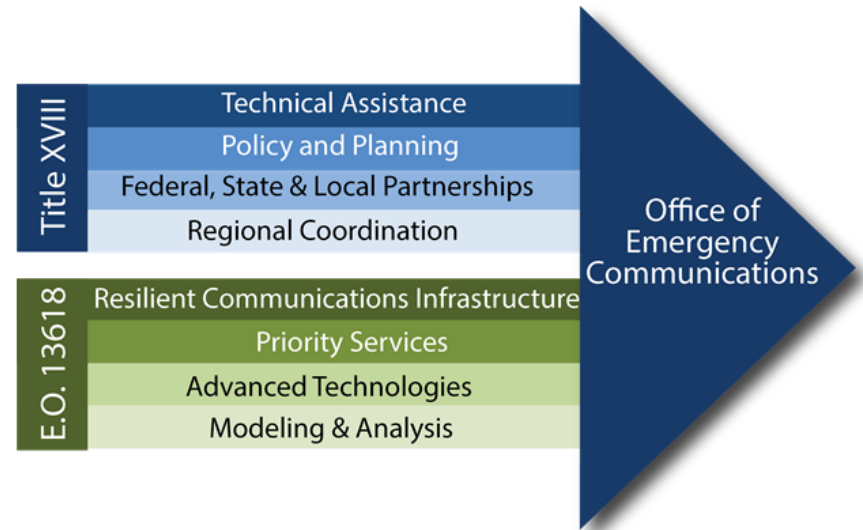
# OEC Background



# Office of Emergency Communications

***Mission: OEC leads the coordination of interoperable emergency communications at the Federal, State, local, and tribal levels and supports national security/emergency preparedness communications.***

- **OEC expanded in Nov 2012 to include several National Communications System (NCS) functions.**
- **OEC now includes:**
  - **Architecture and Advanced Technology Branch**
  - **Communications Portfolio Management Branch**
  - **Policy and Planning Branch**
  - **Public Safety and National Security/Emergency Preparedness Partnerships Branch**
  - **Regional Coordination Branch**
  - **Technical Assistance Branch**

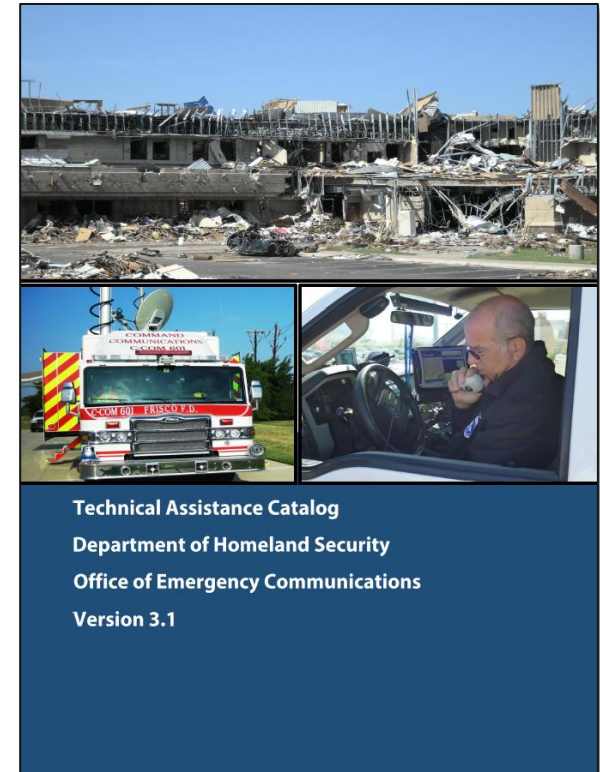


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# Approaches to OEC TA

- **State-Requested TA**
  - **Supports State/local interoperable communication needs in multiple areas**
    - For example, operations, training, exercises, governance and SOPs; engineering; CASM
  - **Supports State/local emergency communications strategies: SOP ; guidelines; TICPs; SCIPs**
  - **Furtheres goals and objectives of NECP**
  - **Submitted via SWICs**
- **National Priority TA Offerings**
  - **Vary year to year**
  - **Special TA focused on specific capability or stakeholder group, for example, NPSBN/FirstNet, Tribal Nation outreach**
- **Automated Tools ([www.publicsafetytools.info](http://www.publicsafetytools.info))**
  - **Specially designed web-based tools assist stakeholder/agencies with ongoing emergency communications needs**
  - **Features OEC-developed tools and stakeholder inputs**



Technical Assistance Catalog  
Department of Homeland Security  
Office of Emergency Communications  
Version 3.1



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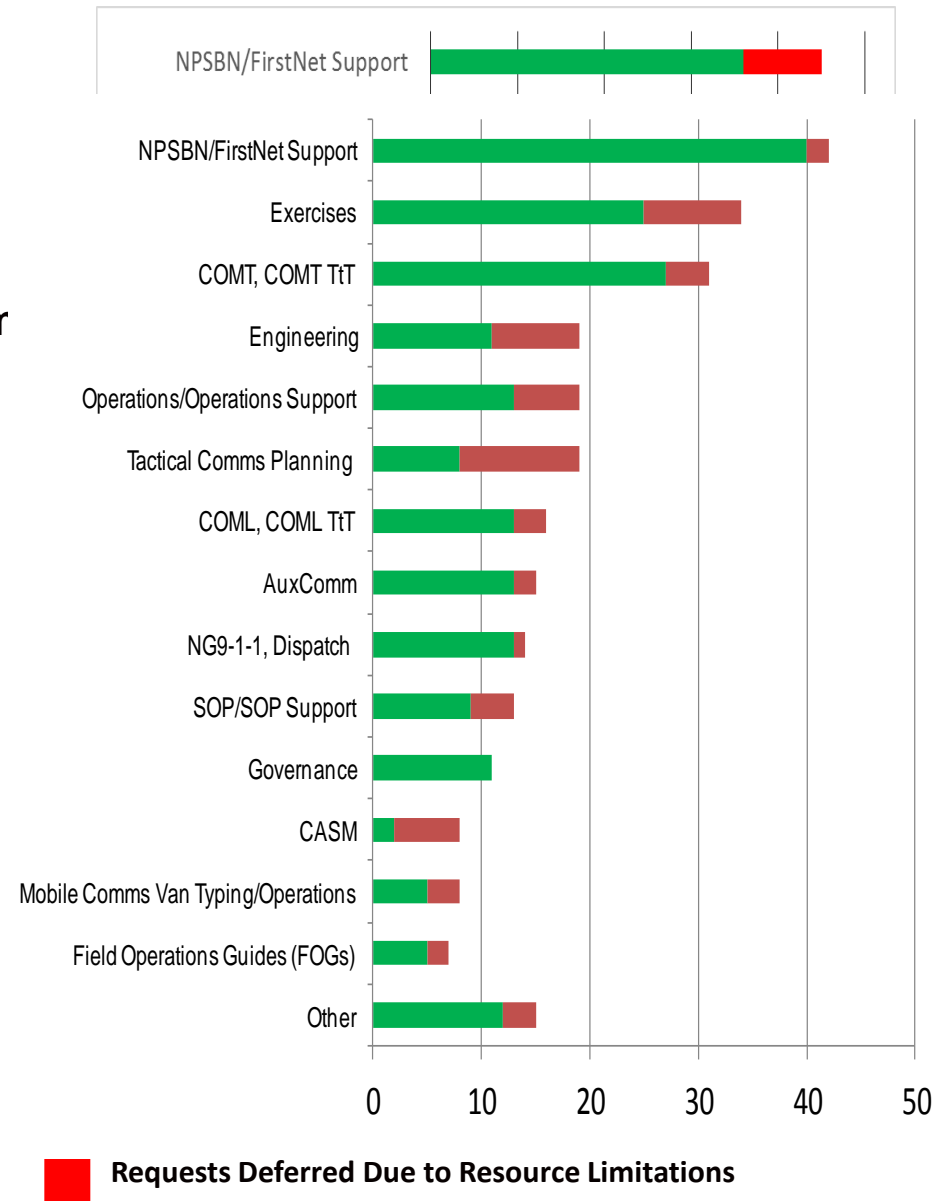
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# FY2014 TA Requests

- Online TA Request and Evaluation Forms:

[www.publicsafetytools.info](http://www.publicsafetytools.info)

- FY 2013 Requests
  - Supported a total of 141 requests from 47 States / Territories
- FY 2014 Requests
  - 180 requests to date from 48 states
  - 80 requests accepted to date
  - Next round of acceptances occurred on **December 16**
- States with less than 5 requests for FY 2014 can still submit



# Public Safety Tools Website

**ICTAP**  
Interoperable Communications Technical Assistance Program

Public Safety Technical Assistance Tools  
Welcome to the Public Safety Technical Assistance Tools Website

HomeToolsResourcesTrainingPSToolsHelpWhat's New (as of 12/09/2013)

**Tools**

**FMT**  
Frequency Mapping Tool

**MDST**  
Mobile Data Survey Tool

**NLST**  
Narrowband License Status Tool

**NSTT**  
Narrowband SummaryTracker Tool

**PS Library**  
Public Safety Library

Controlled Access:

**CASM NextGen**  
Communication Assets Survey & Mapping Next Generation

**RLCT**  
Response Level Communications Tool

**Resources**

**NIFOG Info**  
National Interop. Field Operations Guide

**AUXFOG**  
Aux. Communications Field Operations Guide

**NPSBN**  
Nationwide Public Safety Broadband Network

**OEC Docs.**  
Office of Emergency Communications

**TA Request**  
Technical Assistance Catalog, Request & Evaluation Forms

**FCC Src.**  
Federal Communications Commission

**Training**

**Gateways**  
Audio Gateway Training Materials & CBT

**COMU**  
Communications Unit Overview Training

**AUXCOMM**  
Aux. Communications Overview Training

**Proj. Mgmt.**  
Project Management Overview Training

**Radio 101**  
Basic LMR Overview Presentation

**Tribal Outreach**  
Engaging Tribal Governments Overview Presentation

[www.publicsafetytools.info](http://www.publicsafetytools.info)



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# OEC Consultation Prep Workshop

- **On-Site workshop focuses on preparing States for the consultation process with FirstNet**
- **Half day meeting is divided into two components:**
  - **Broadband 101**
  - **Coverage / Users**
- **OEC provides various GIS datasets to assist discussion on public safety operational coverage needs**
- **User Information is compiled from FEMA, Department of Justice, CASM and commercial databases**

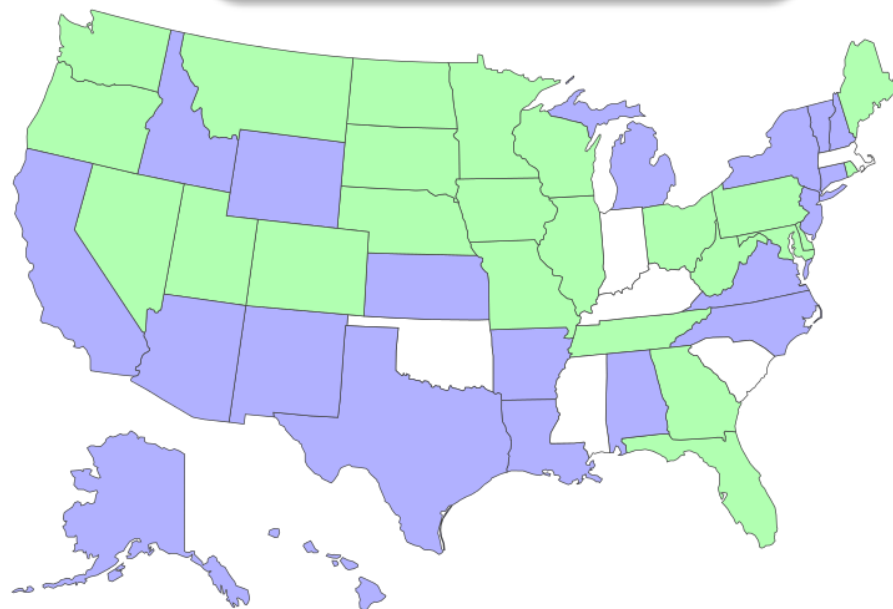
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**Completed**



**Planned / Requested**

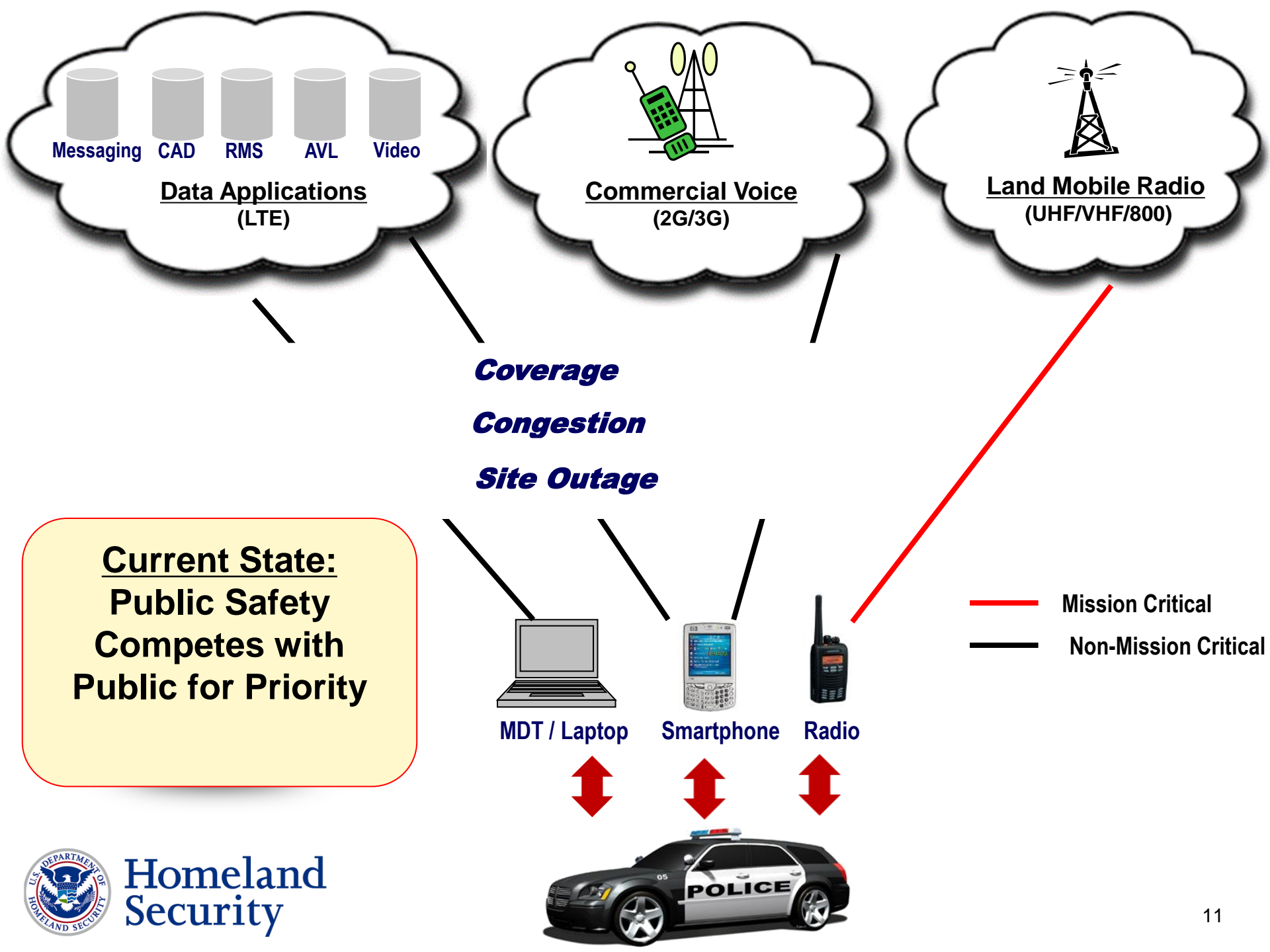


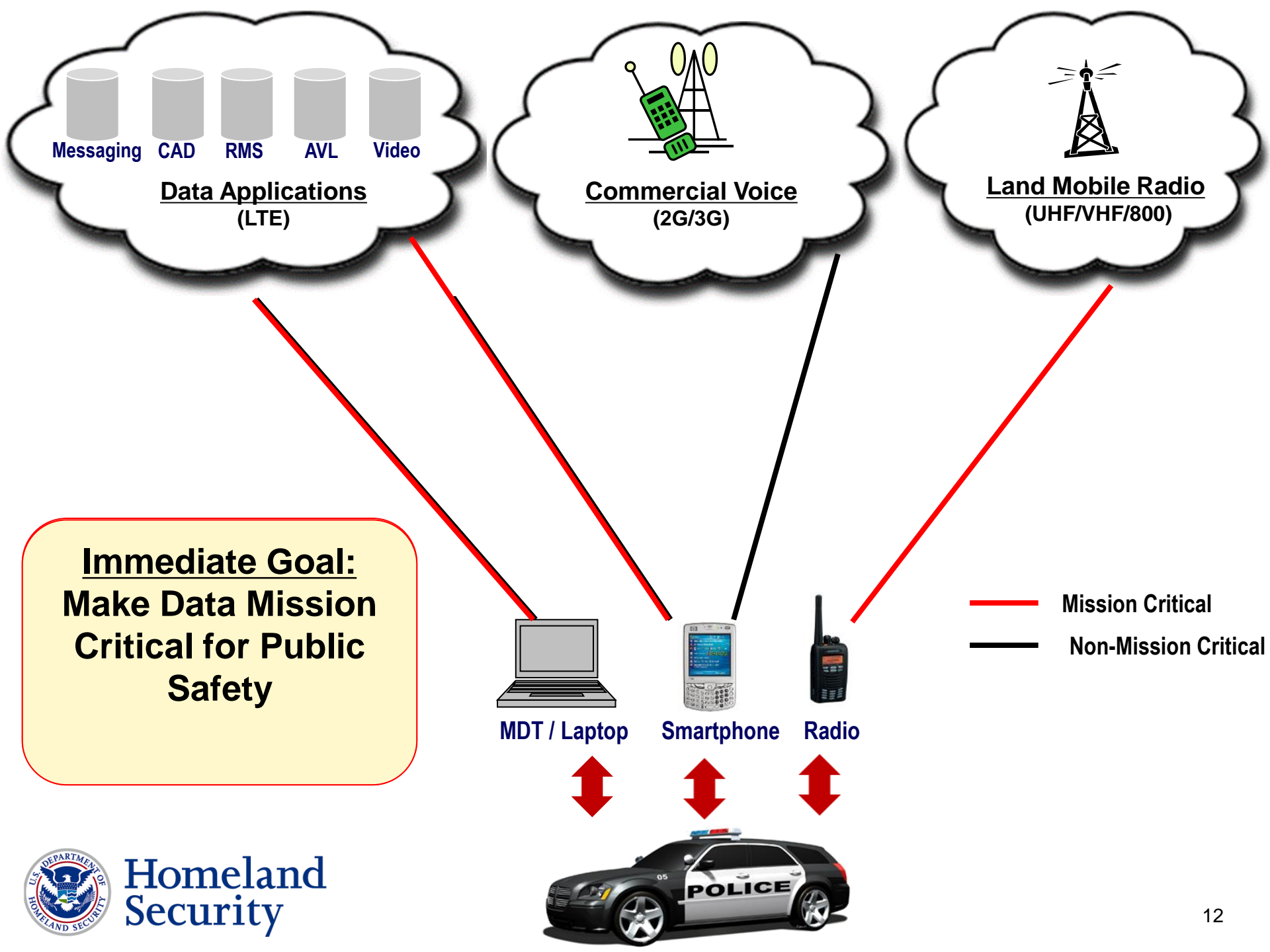
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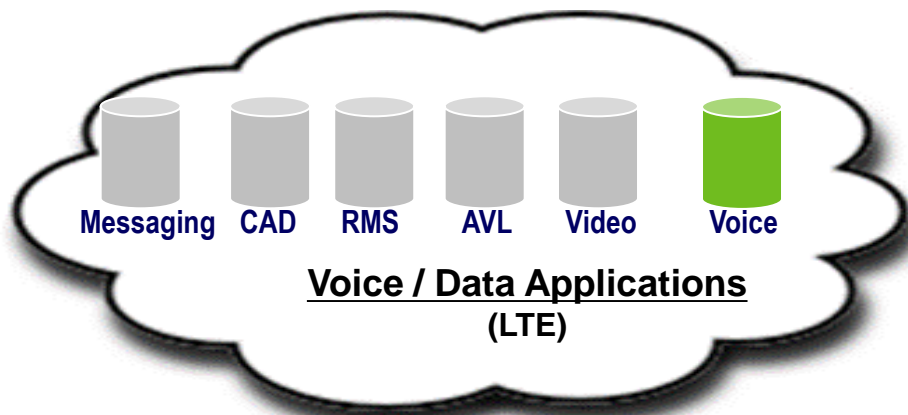
# Broadband Overview











**Long-Term Goal:**  
**Develop Mission**  
**Critical Voice**  
**over LTE**



MDT / Laptop



Smartphone



Radio

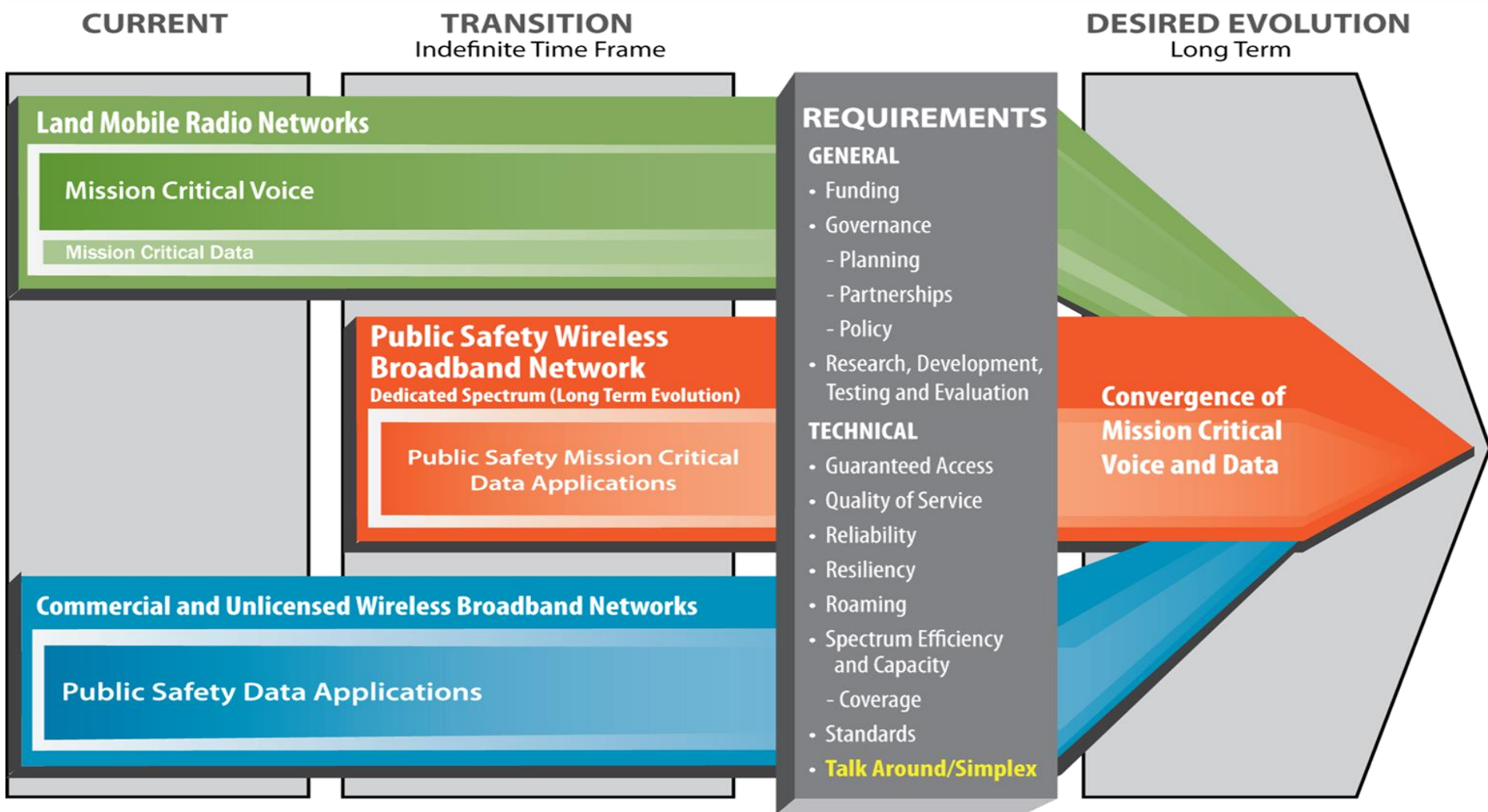


— Mission Critical  
— Non-Mission Critical



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# Planning for Convergence



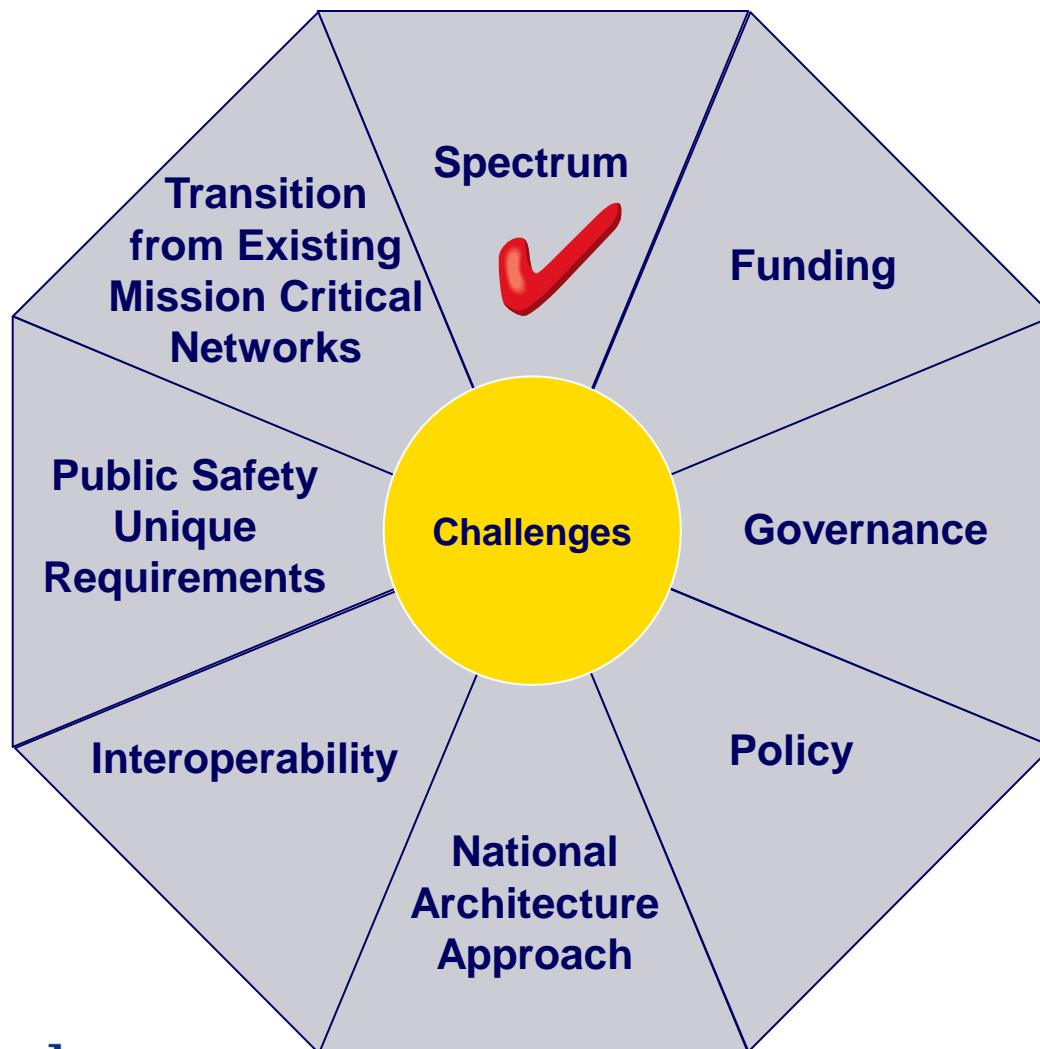
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# The Proposed Solution

- **Create next generation nationwide public safety wireless network**
- **Provide high data rates (“broadband”) to enable advanced applications**
- **Use industry standards to enable interoperability for public safety**
- **Adopt fourth generation (“4G”) cellular technology to leverage fast pace of commercial development**
- **Leverage commercial equipment economies of scale while maintaining public safety unique requirements**

**Nationwide Public Safety Broadband Network (NPSBN)  
deploying Long Term Evolution (LTE)**

# Key Challenges to Address



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# Long Term Evolution (LTE) Technical Highlights

# LTE Technical Highlights

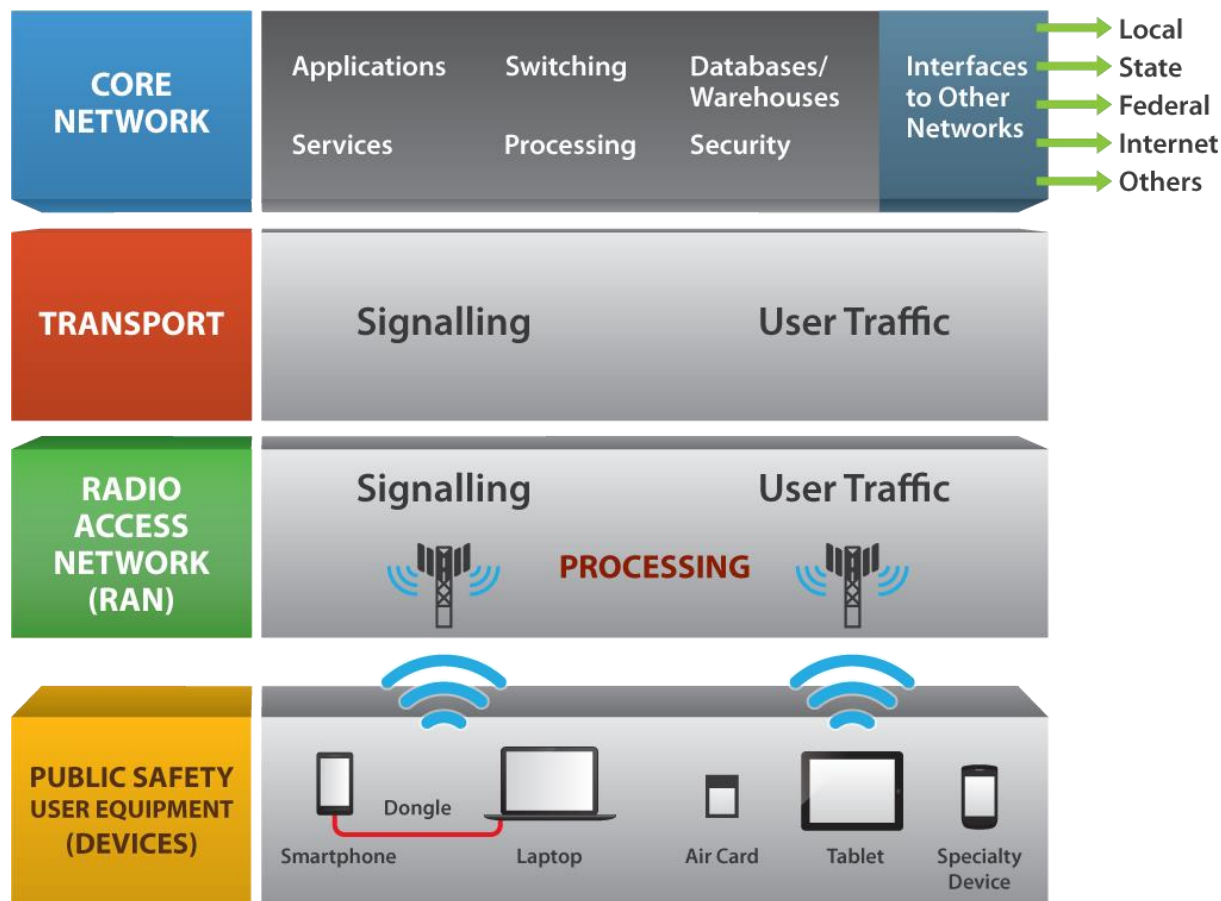
- Considered to be one of the **4G** standards (Wi-Max and HSPA+)
- Cellular standard that was designed for **data first** and not voice
  - Inclusion of LTE standardized voice is a work in progress
- **All-IP** (Internet Protocol) architecture designed for low latency
- Potential for **economies of scale** by leveraging commercial market
- Inter-network **mobility and interoperability** with commercial carriers
- **Flexible** channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz
- **High user data rates** to support new applications
- **Security and authentication** mechanisms
- **Priority and Quality of Service** mechanisms
- **Modern antenna techniques** to support improved performance



# Basic LTE Network Components

- At a very high level, the network has 4 basic Components:

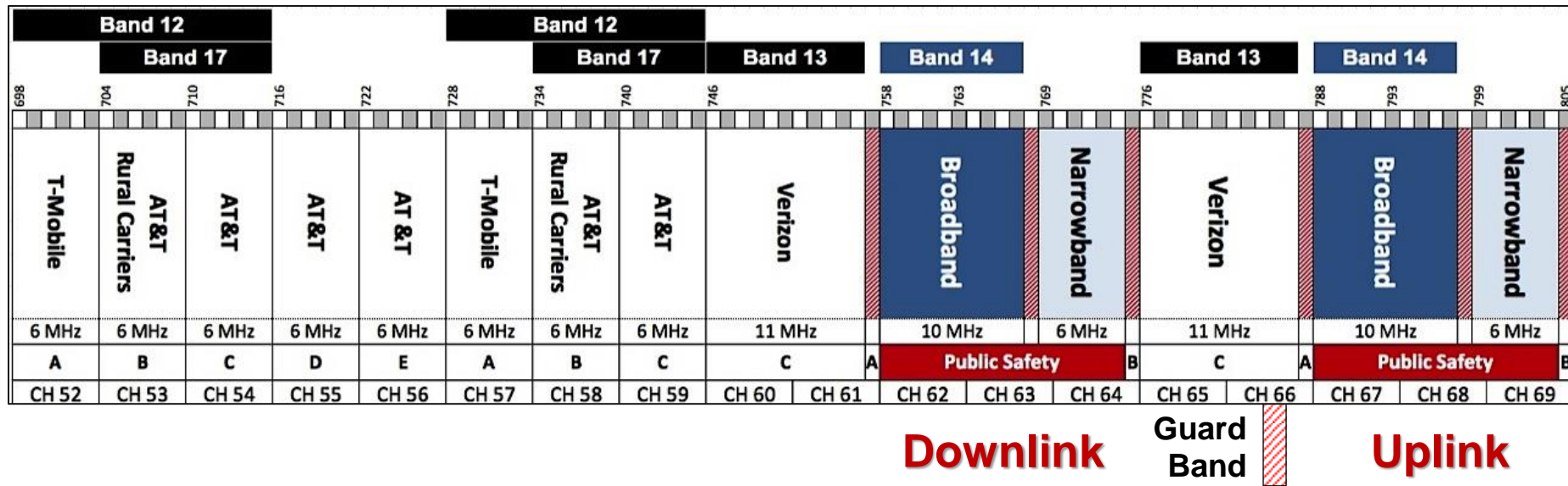
1. Core Network Evolved Packet Core (EPC) or “Core”
2. Transport “Backhaul”
3. Radio Access Network (RAN) or “Radio Sites”
4. User Equipment (UE) or “User Device”





# 700 MHz Band Allocation

- Public Safety's Broadband allocation is **Band Class 14**
  - FirstNet is the license holder for that spectrum
- Major carriers operate in Bands 12, 13 and 17 and bands outside of 700 MHz
  - Today's commercial devices won't operate in Band Class 14
  - Public Safety's allocation is comparable to commercial carriers LTE nationwide deployments





# Defining Mission Critical Voice

- **NPSTC produced a 7 page document defining mission critical voice**
  - <http://www.npstc.org/broadband.jsp>
- **Requirements identified the following:**
  - **Direct or Talk Around Mode (off network communications)**
  - **Push-to-Talk (PTT) w/ low latency**
  - **Full Duplex Voice (commercial/PSTN calls)**
  - **Group Call (one to many)**
  - **Talker Identification**
  - **Emergency Alerting (highest level of priority)**
  - **Audio Quality**
- **Definition being used as a reference for standards developments**
- **No standardized solutions exist today that can meet all of these requirements**

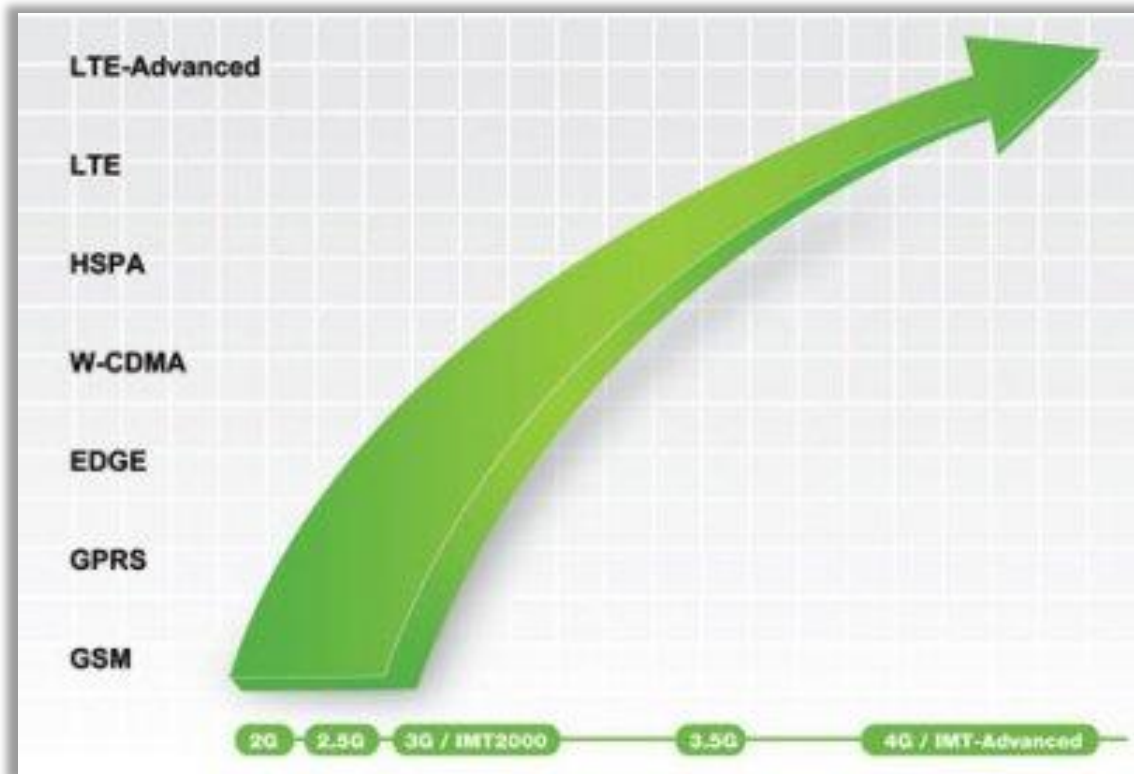


# Voice Summary

Voice Category	Status	
<b>VoIP</b>	Demonstrated in several applications	Green
<b>LTE Voice Standard</b>	VoLTE preferred solution; just being implemented by some carriers	Yellow
<b>Non-mission critical PTT</b>	Standard and proprietary options available	Yellow
<b>Mission critical PTT</b>	Standardized approach being worked on within current standards developments	Red
<b>Direct mode</b>	Also being worked on within standards efforts; includes peer-to-peer data as well	Red

# Evolution of Cellular Standards

- LTE is a global standard developed by 3GPP (3<sup>rd</sup> Generation Partnership Program)
- Roadmap for future growth of the technology into LTE Advanced
- Future releases will include public safety requirements
- All US carriers migrating to a single standard for the first time



# FirstNet and the Nationwide Public Safety Broadband Network



# Creation of FirstNet

## Middle Class Tax Relief and Job Creation Act of 2012

- **Public Safety Priority:** Passage of legislation to reallocate spectrum was top legislative priority of every public safety association in the United States
- **D Block:** D Block 700 MHz spectrum was reallocated to public safety
- **FirstNet:** Law created First Responder Network, an independent authority under NTIA / Dept. of Commerce
- **Nationwide Approach:** License for public safety broadband given to “FirstNet”
- **FirstNet Funding:** FirstNet provided \$2 billion upfront and a total of up to \$7 billion for network construction
- **State Planning Funds:** Up to \$135 million State and Local Implementation Grant program (SLIGP) is provided by the NTIA to help State planning efforts in support of FirstNet consultation
- **Opt In/Out Provision:** States have the opportunity to opt-out of the nationwide build-out and develop its own interoperable system with FCC approval

# Funding

- Planning and Implementation funding is provided through the spectrum auctions
- Funds are available until Sept. 30, 2022; revert to the Treasury for deficit reduction after
- By law, the network is to be self sustaining upon expending \$7 Billion

Phase	Funds	Purpose
Planning	\$135 Million	Grants to assist States/Territories with planning & implementation. Requires 20% match
	\$7 Billion	\$2 Billion provided up front to start planning, designing and early implementation
Implementation		Remaining \$5 Billion to be provided from spectrum auctions; used to complete network build out
Sustainment	Ongoing	<p><b>Network User Fee:</b> Fee from each entity including public safety or secondary user that uses the Network</p> <p><b>Lease Fee for Network Capacity:</b> Fee for agreement between the FirstNet and secondary user to permit secondary access</p> <p><b>Lease Fee for Network Equipment/Infrastructure:</b> Fee for entity that seeks access or use of antennas, towers, etc. constructed or owned by FirstNet</p>



# FirstNet Approved Budget

- FirstNet's FY14 budget was approved at the August Board Meeting

*in \$000*

Major Activity*	Operating Expenses	Capital Expenses	Total
Network Partners	\$9,250	\$174	\$9,424
Mandate: Core Network	\$14,109	\$40,464	\$54,573
Mandate: State Network Plans	\$11,098	\$8,889	\$19,987
Mandate: State Consultation	\$32,830	\$1,224	\$34,054
Early Mover Projects	\$1,266	\$434	\$1,700
Deployable Systems	\$1,102	\$10,238	\$11,340
Wireless Devices	\$2,843	\$420	\$3,263
Company Foundation	\$49,921	\$9,738	\$59,659
<b>Total</b>	<b>\$122,419</b>	<b>\$71,581</b>	<b>\$194,000</b>

# Responsibilities of FirstNet by Law

## Consultation

*Consult with Federal, State, local and Tribal public safety entities, NIST, FCC and the PSAC*

## Management

*Select a program manager, consultants and other committees*

## Standards

*Ensure nationwide standards for use and represent public safety on standards bodies*

## Certified Equipment List

*Ensure the development of a list of certified devices and components*

## RFPs

*Issue RFPs for the purposes of building, operating, and maintaining the network*

## Commercial Infrastructure

*Leverage existing commercial wireless infrastructure to speed deployment of the network*

## Contracts

*Manage and oversee the implementation and execution of contracts or agreements with non-Federal entities*

## Cybersecurity

*Ensure the safety, security and resiliency of the network to protect against cyberattacks*

## PSAPs

*Promote integration of the network with PSAPs or their equivalents*

## Rural

*Implement deployment phases with substantial rural coverage milestones*

## Prohibition on Consumer Service

*FirstNet CANNOT offer, provide, or market commercial telecommunications or information services directly to consumers*



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# FirstNet Board Members

## Requirements: 15 Total Members

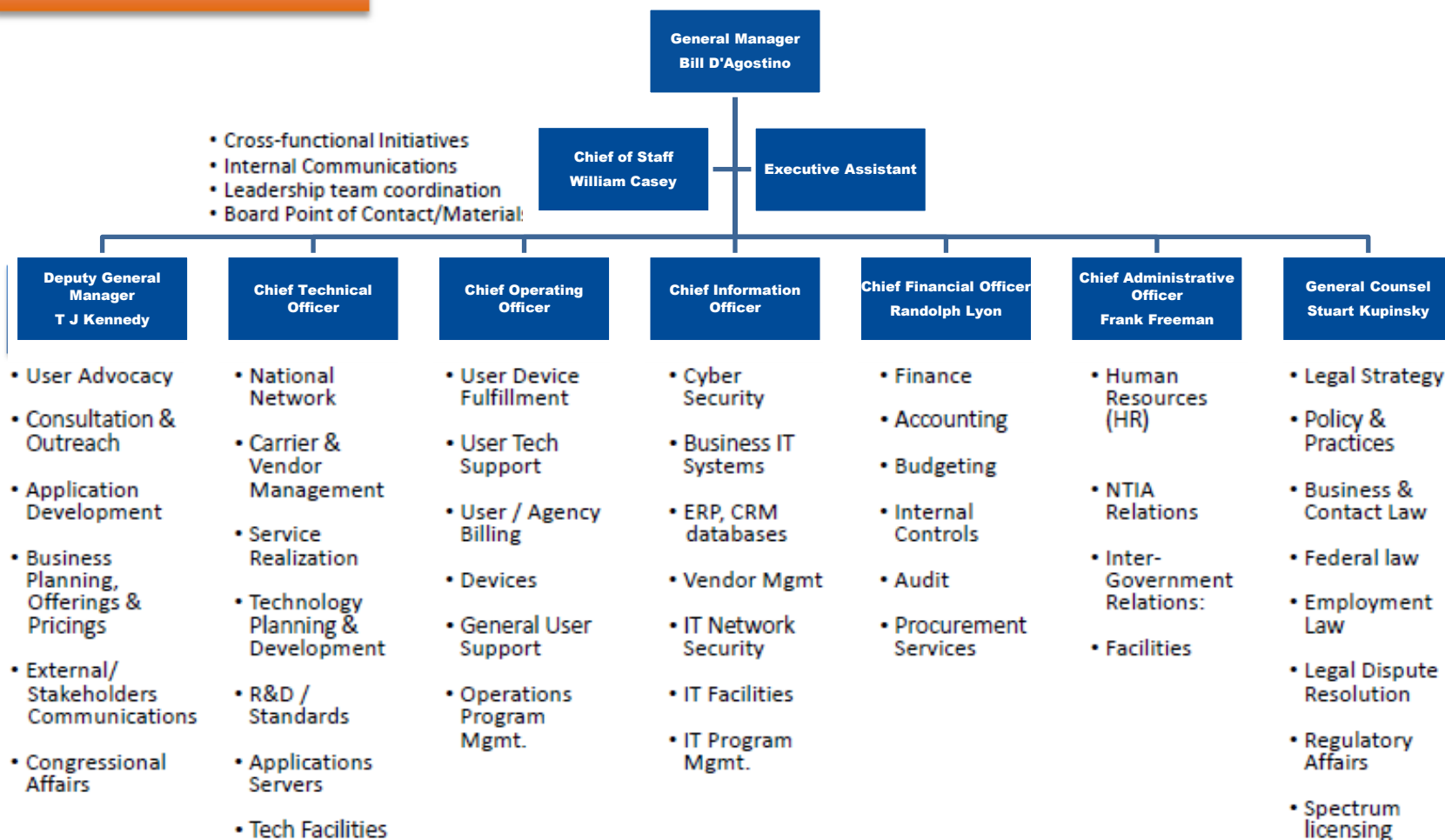
- 3 Permanent Members
- 12 Members (public safety, tech, or financial expertise)
  - 3 Public Safety Professionals
  - 3 State/local/tribal reps

1. **Secretary of Homeland Security** (Term: Permanent)
2. **Attorney General** (Term: Permanent)
3. **Director of the Office of Management and Budget** (Term: Permanent)
4. **Tim Bryan**, CEO, National Rural Telecommunications Cooperative (Term: 3 years)
5. **Charles “Chuck” Dowd**, Deputy Chief, New York City Police Department (Term: 2 years)
6. **F. Craig Farrill**, Wireless telecommunications executive (Term: 3 years)
7. **Paul Fitzgerald**, Sheriff, Story County, Iowa (Term: 2 years)
8. **Samuel “Sam” Ginn** (Chairman), Telecommunications executive (Term: 2 years)
9. **Jeffrey Johnson**, Fire Chief, retired, CEO Western Fire Chiefs Association; Oregon (Term: 3 years\*)
10. **Ed Reynolds**, Retired telecommunications executive (Term: 3 years)
11. **Kevin McGinnis**, Chief/CEO, North East Mobile Health Services (Term: 3 years)
12. **Susan Swenson**, Telecommunications/technology executive (Term: 3 years\*)
13. **Teri Takai**, DoD CIO; former CIO, States of Michigan & California (Term: 3 years\*)
14. **Wellington Webb**, Founder, Webb Group International; former Mayor, Denver, Colorado (Term: 3 years)
15. **Barry Boniface**, Private equity investor and telecommunications executive (Term: 3 years)

*\* Reappointed to 3 year terms at August 2013 Board Meeting*

# FirstNet Management

## Leadership Team



# FIRSTNET REGIONAL STRUCTURE

The FirstNet operational outreach model aligns with 10 FEMA regions.



## 10 Regional Teams

Work through the State POCs

Reach into cities and other localities

Current Focus: State consultation

Future Focus:

- Solution sales
- Support
- Account Management
- Outreach
- Education and training

FEDERAL  
TEAM

TRIBAL  
TEAM

## 2 Nationwide Teams

Gather input and requirements

Serve users

# Public Safety Advisory Committee (PSAC)

- **The PSAC was created by law to provide input and guidance to FirstNet**
- **It consists of 41 member representing public safety organizations**
- **The PSAC has a 5 member Exec. Committee:**
  - Harlin McEwen, Chair (IACP)
  - Bill McCammon, Vice Chair (Metro Fire Chiefs)
  - Paul Patrick, Vice Chair (NASEMSO)
  - Heather Hogsett, Vice Chair (NGA)
  - Tom Sorley, Vice Chair (USCM)
- **Current PSAC initiatives for FirstNet**
  - **Defining requirements that meet Public Safety Grade**
    - Coverage, Reliability, Resiliency, Emergency communications, Group communications
  - **Developing over the horizon/human factors**
  - **Use cases by entity/discipline**
  - **Identity management**

# FirstNet 3-in-1 Approach

## COVERAGE

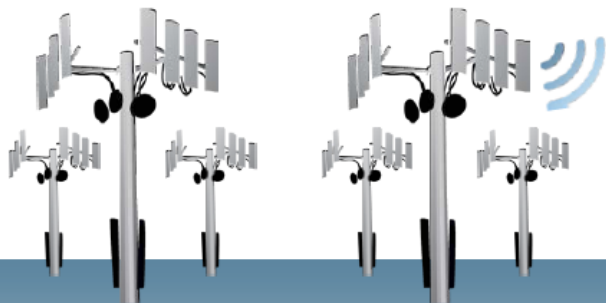
**Diverse Coverage Architecture: considering a “3-in-1” Approach:  
Terrestrial + Satellite + Deployable**



**#2:  
Mobile Satellite Systems**



**#1:  
Multiple Terrestrial Mobile Systems**



**#3:  
Deployable Systems**



**Public Safety User**

# FirstNet Solution

## NETWORK

**FirstNet will enable communications and provide a diverse mix of services and applications.**



### Communication

- Video: 1-to-many
- Messaging
- Images
- Group Text
- Voice: Non-Mission Critical

### Applications

- Your applications (Private, Selective sharing)
- FirstNet Applications
- Syndicated Applications



### Services

- Data Storage
- Recordkeeping
- Search
- Databases (CJIS, etc.)

### Capabilities

- NOC Status
- Activation
- Product Ordering
- Dynamic Priority Access



Regional Conference

© First Responder Network Authority



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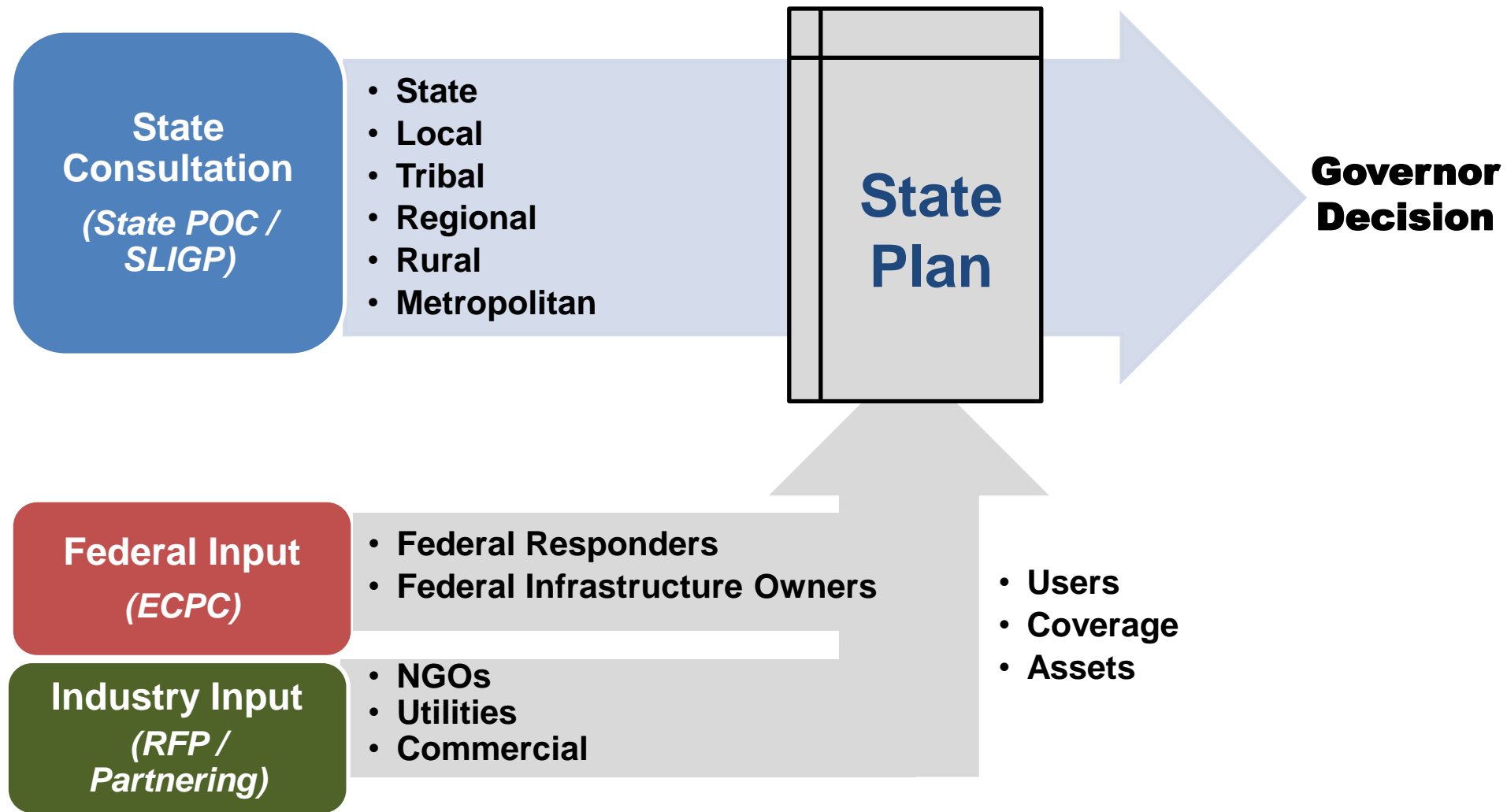
# FirstNet and State Consultation

# FirstNet Consultation with State

- The single officer or governmental body is expected to consult with FirstNet on several policies, including:
  - Construction of a Core and RAN build out
  - Placement of towers
  - Coverage areas of the network
  - Adequacy of hardening, security, reliability, and resiliency requirements
  - Assignment of priority to local users
  - Assignment of priority and selection of secondary users
  - Training needs of local users
- SLIGP funding is intended to support State consultation



# Wide Range of Stakeholder Consultation

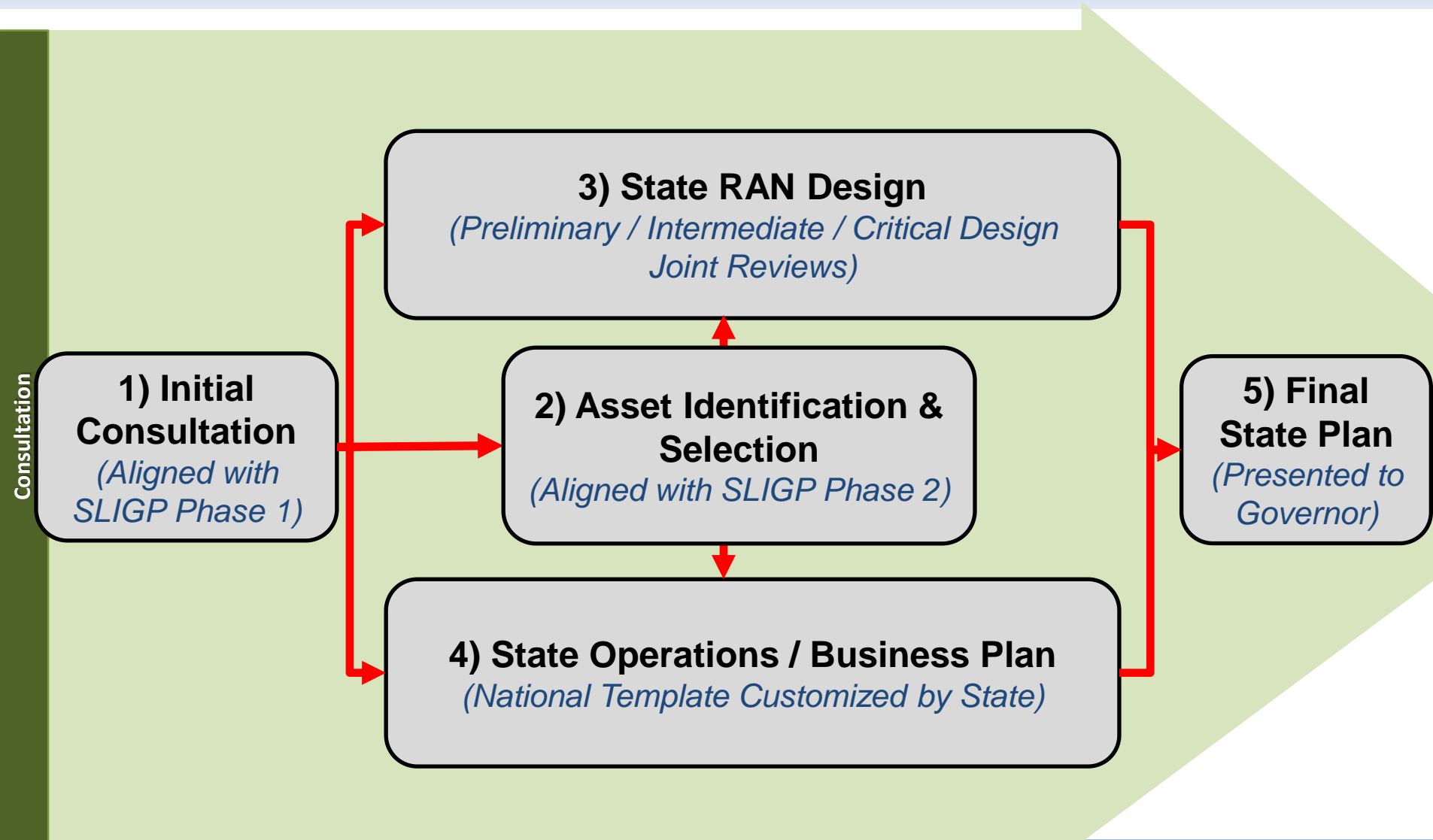


# Overview of Consultation Process

- **Consultation is an active process, not a single event.** FirstNet will collaborate and partner with stakeholders in a meaningful consultation process.
- **FirstNet will communicate the consultation process and necessary roles and responsibilities.** It will be clear to the stakeholders what the process is and what the expectations are for those involved.
- **Consultation will focus only on critical information and data.** FirstNet will focus on gathering only absolutely necessary data to help build the network.
- **Plan development will be iterative.** Stakeholders and FirstNet will have the opportunity to refine information and improve drafts.
- **Consultation culminates with the creation of the State Plan.** State Plans will be created with the information gathered during the consultation process.

**Together, Stakeholders and FirstNet will have engaged in a process that provides meaningful and thorough information for the State Plans.**

# Defining The Process



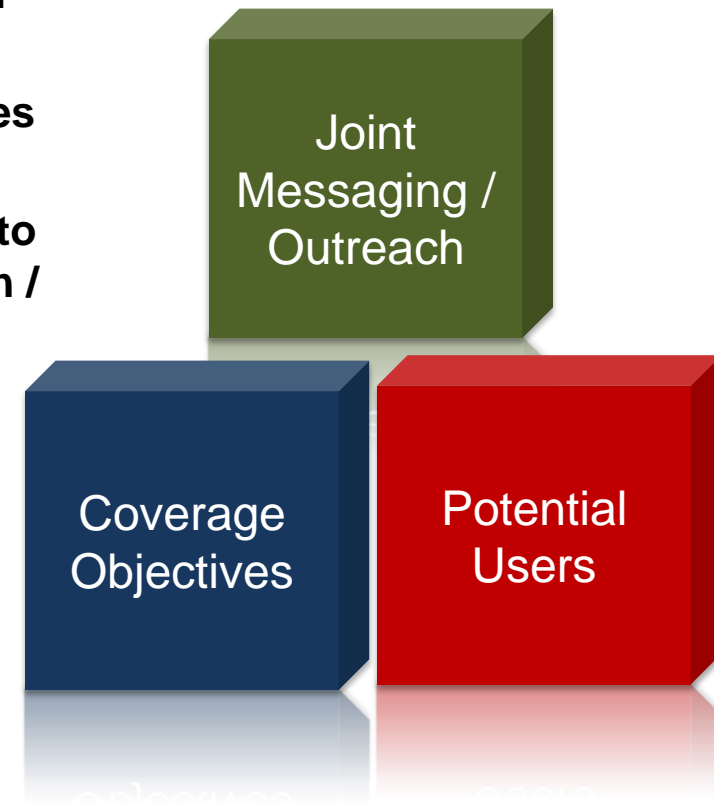
# 1 – Initial Consultation *(Aligned with SLIGP Phase 1)*

- **Key Steps**

- Define consultation process & roles / responsibilities
- Discuss Baseline State Analysis (BSA) with each State / Territory
- States validate / improve BSA coverage objectives and detailed user information
- Upon completion by State, hold on-site meeting to review state analysis and discuss joint education / outreach

- **Guiding Principle**

- Coverage objectives and user information is critical to support the State RAN design efforts
- All States may begin process concurrently
- Ask States to validate & enhance rather than recreate
- Address plan for joint messaging / outreach process and materials to stakeholders at all levels



# 2 – Asset Identification & Selection

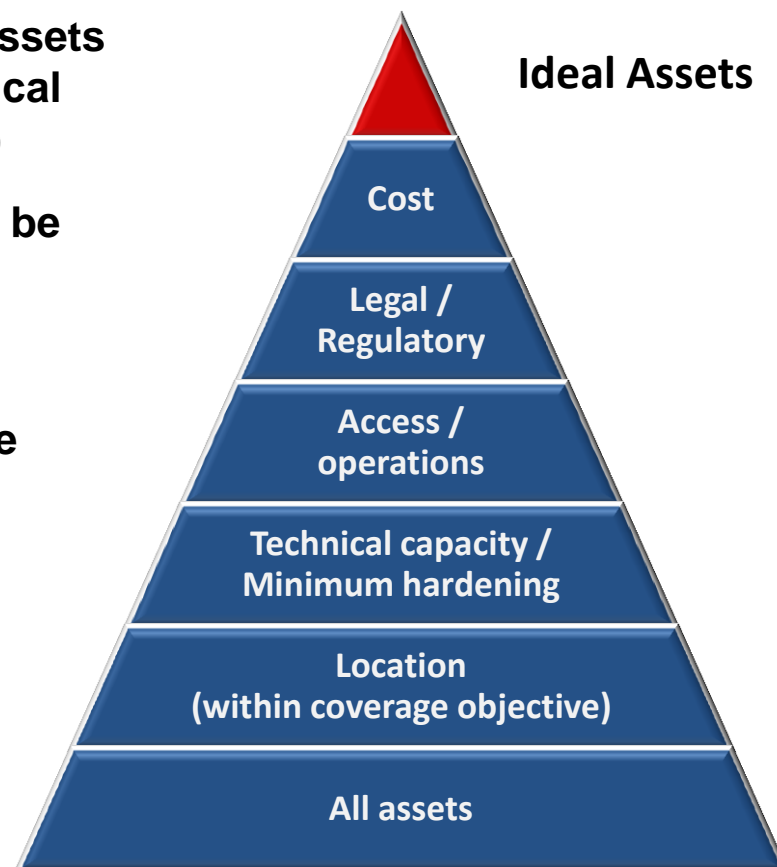
*(Aligned with SLIGP Phase 2)*

- **Key Steps**

- Define minimum recommended attributes of assets for consideration (Coverage objective / Technical capacity / Site access / Operations / Low cost)
- Request data collection on available assets to be considered
- Assess all assets (commercial & public)
- Select assets based solely on best value to the FirstNet network

- **Guiding Principle**

- Limit data collection to viable assets to save the State time/effort
- Leverage assets to provide better coverage at a lower cost
- Leverage assets to deploy quicker



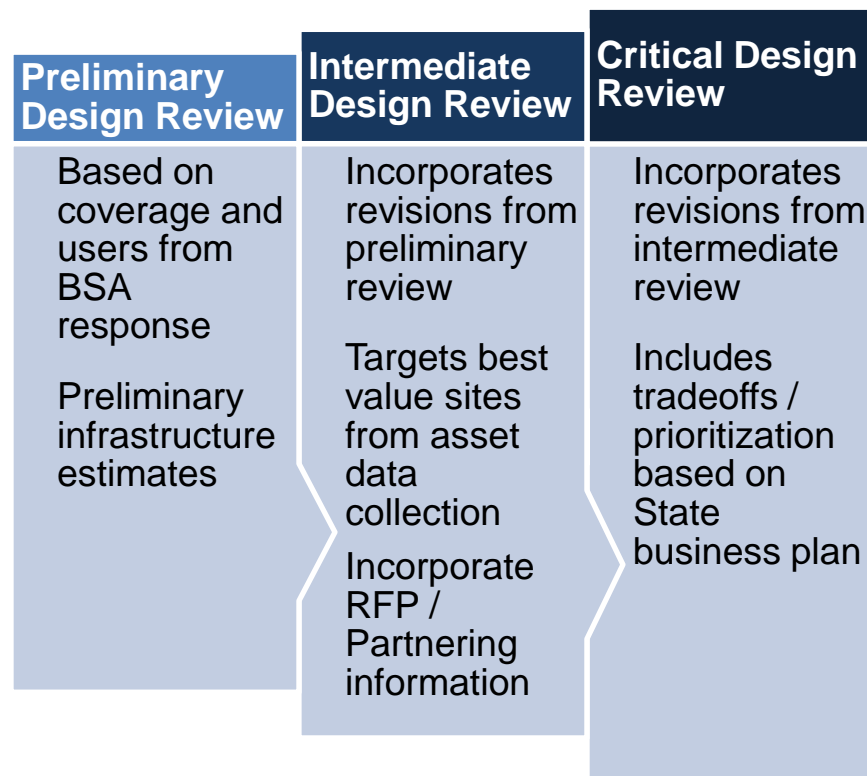
# 3 – State RAN Design Process

- **Key Steps**

- **Multi-phase (preliminary / intermediate / critical design reviews) review with State to refine design based on identified priorities**
- **Incorporate feedback and additional data as it is collected (SLIGP Phase 2 / RFP Process)**

- **Guiding Principle**

- **Ensures on-going review / refinement process with State**
- **Jointly develop tradeoffs and priorities**



# 4 – State Operations/Business Plan

- **Key Steps**

- **Leverage PSAC and others to discuss overall approach to:**
  - Local control
  - Prioritization
  - Training
  - Security
- **Develop operations template with areas for input/customization**
- **Develop system cost structure / business plan for State based on preliminary RAN design and potential user base**
- **Customize based on public safety stakeholder input**

- **Guiding Principle**

- **Addresses areas of consultation required by law**
- **Ensure State RAN design is informed by impact to business plan / cost considerations**



# 5 – Final State Plan Preview

- **Key Steps**

- **Combine State RAN Design with Operations / Business Plan**
- **Projected funding level**
- **Provide final review opportunity by State POC / Governing Body**
- **Submit to the Governor**

- **Guiding Principle**

- **Addresses areas of consultation required by law**
- **Ensures Public Safety stakeholders have had robust involvement before State Plan is presented**

## **State Plan Requirements**

- Completion of the RFP process
- Details of proposed build-out in the State
- Funding level for the State





# State Participation – Opt In/Out Option

- **FirstNet will initially provide a plan/RFP to States including their proposed allocation of network construction funding.**
- **Within 90 days, each State can decide if they want to participate in the NPSBN deployment, or they can opt out and build out their own individual State network.**
- **States opting out have 6 months to submit a plan to the FCC to show that they are interoperable with the nationwide network.**
- **State Plans must demonstrate:**
  - Technical and fiscal capability to operate the State radio access network
  - Ability to maintain ongoing interoperability with the nationwide network
  - Capacity to complete the project within specified comparable FirstNet timelines
  - Cost-effectiveness
  - Comparable security, coverage, and quality of service to that of FirstNet
- **If FCC approves the plan, the State may apply to the NTIA for a construction grant and lease spectrum capacity from FirstNet.**
- **If FCC disapproves the plan, the FirstNet plan will move forward in the State.**

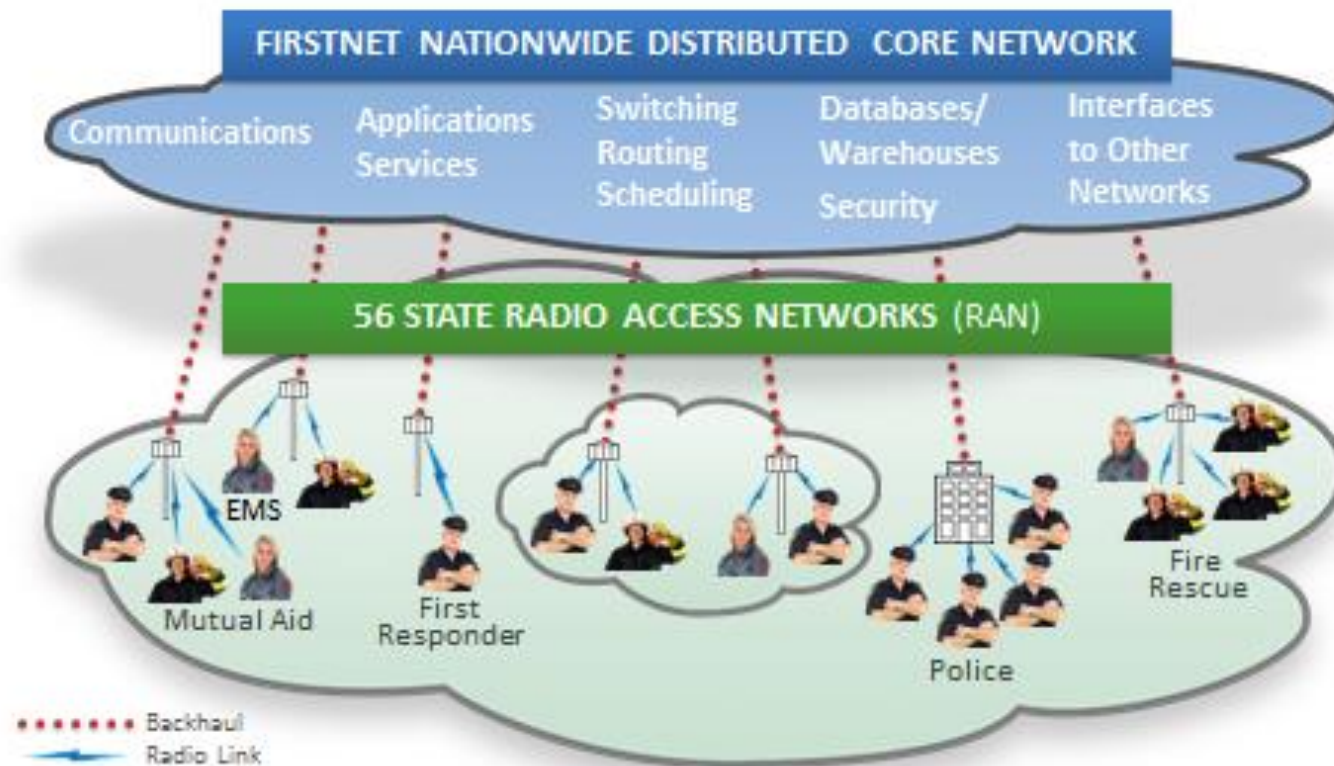
# SLIGP Activities

- **Governance:** Establish or enhance a governance structure to consult with FirstNet;
- **Representation:** Ensure local and tribal representation when the State is consulting with FirstNet;
- **Education:** Conduct education and outreach for all relevant stakeholders that will be involved in the PSBN;
- **Users:** Identify potential public safety users for the PSBN;
- **MOU:** Develop a standard Memorandum of Agreement appropriate for the State to facilitate the possible sharing of infrastructure with FirstNet;
- **Staffing:** Develop staffing plans to involve local and tribal stakeholders in a future data collection in consultation with FirstNet; and
- **SCIP:** Prepare a comprehensive plan as part of the Statewide Communications Interoperability Plan (SCIP), or a plan complementary and similar to the SCIP, describing the public safety needs that the grantee expects FirstNet to address, plus relevant milestones.
- **Infrastructure Data Collection (Phase 2)** - Maximize use of existing public/private assets to reduce cost and speed deployment.

# FirstNet Vision

## NETWORK

### FirstNet: Nationwide Core and Local Radio Access Networks



Regional Conference

First Responder Network Authority



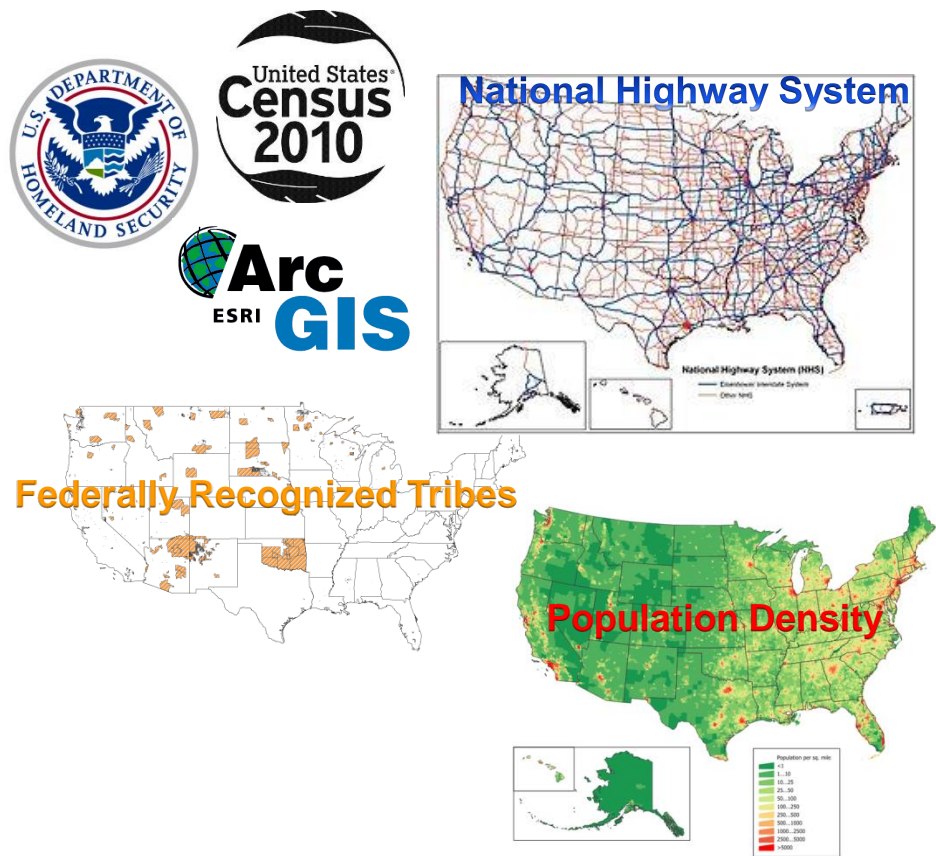
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# Arizona Coverage Objectives

# Coverable Objectives Introduction

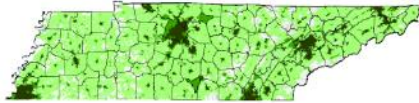
- **Objective:**
  - help states with a starting point of data that can be considered when establishing coverage objectives for FirstNet
- OEC has gathered a variety of nationwide data from several sources to establish a baseline
- OEC has coordinated our baseline with FirstNet to ensure it's a reasonable starting point
- States/Territories can then tailor it to unique Public Safety operational needs



# Guidelines

- **Focus on coverage....not infrastructure**
  - The goal is to define and prioritize operational coverage needs
  - RAN site selection, backhaul, hardening requirements, etc. are for a later discussion
  - These site selection factors will be addressed through SLIGP funding
- **This is a starting point.....nothing is final**
  - The maps provided by OEC are to help States identify its own coverage objectives
  - Many coverage factors/approaches that the State develops can/will adjust throughout the consultation process
- **LTE is a mobile data solution first.....mission critical voice is yet to come**
  - NPSBN will initially support mission critical data and (potentially) supplementary voice
  - System will not replace need for land mobile radio systems (based on current technology)

# Focus on Coverage



## Coverage

- Where is reliable Coverage needed?
- For what level/ device types?
- Using what potential methods?



## Capacity

- How many total users?
- What is their operational area?
- What type of applications do they use?



## RAN Design

- Estimated number of sites
- Initial cost estimate
- Parameters for asset data collection

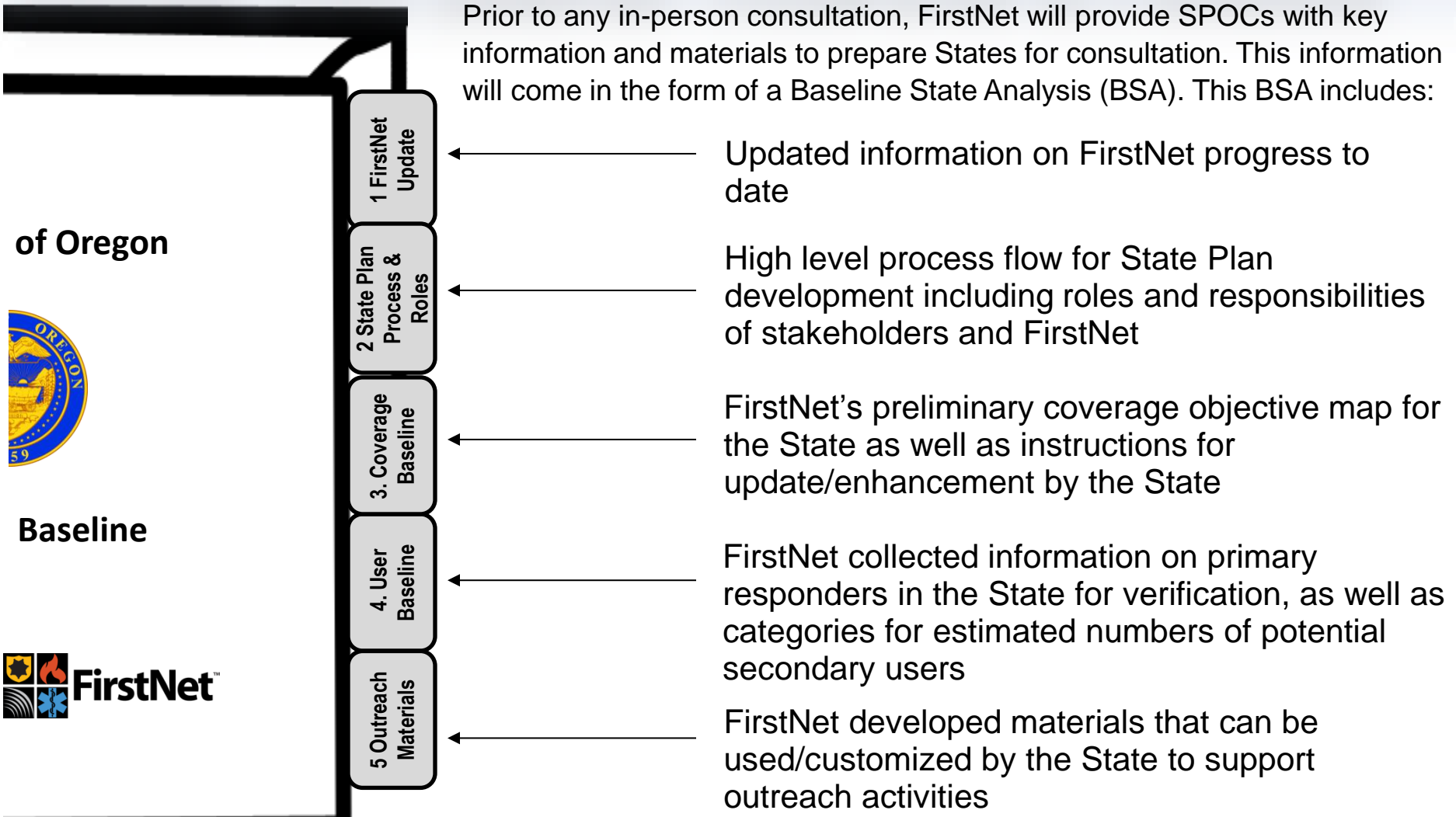


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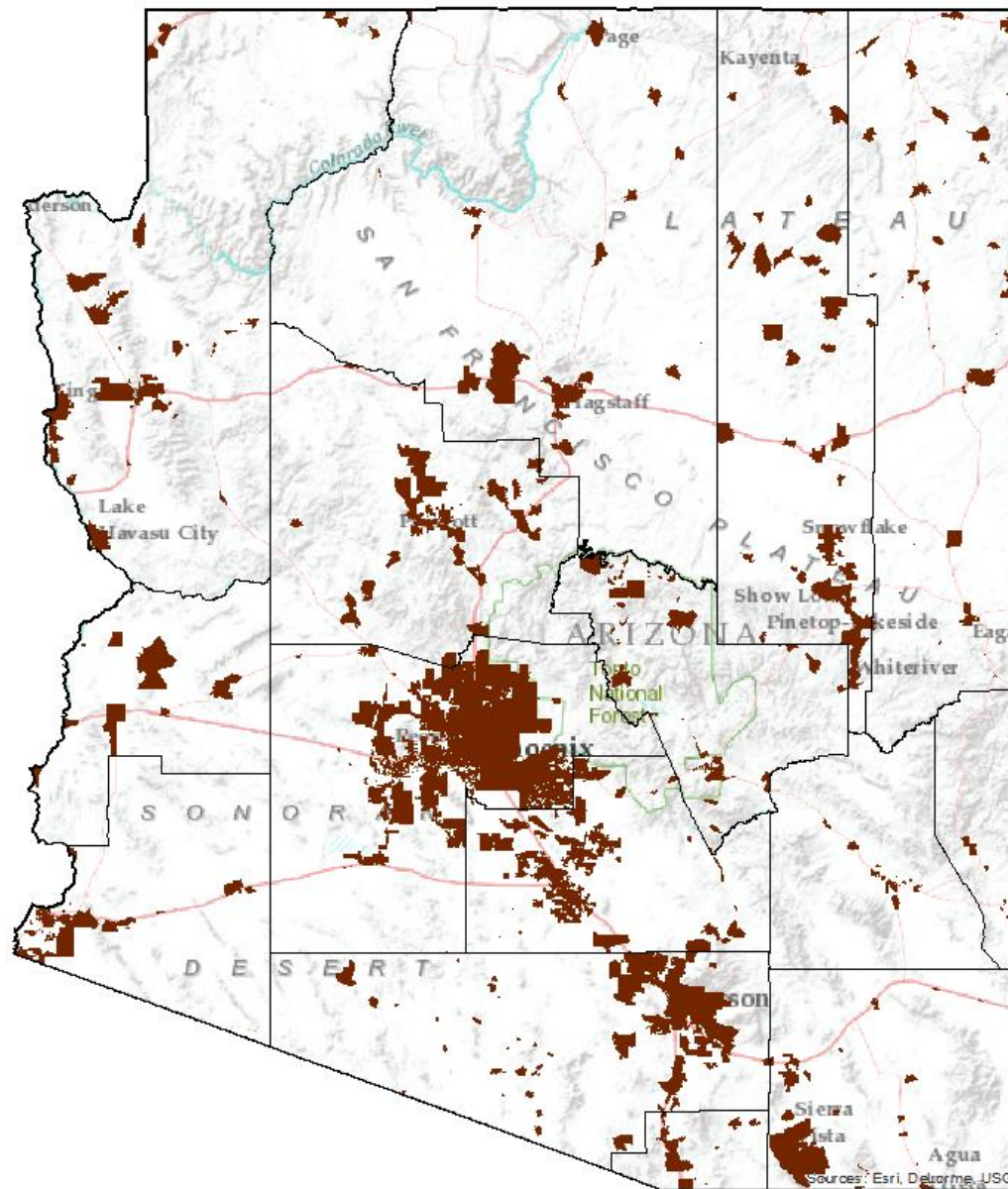
# Baseline State Analysis– Getting Ready for Consultation





# Boundaries









-  State
-  Counties
-  Census Designated Places

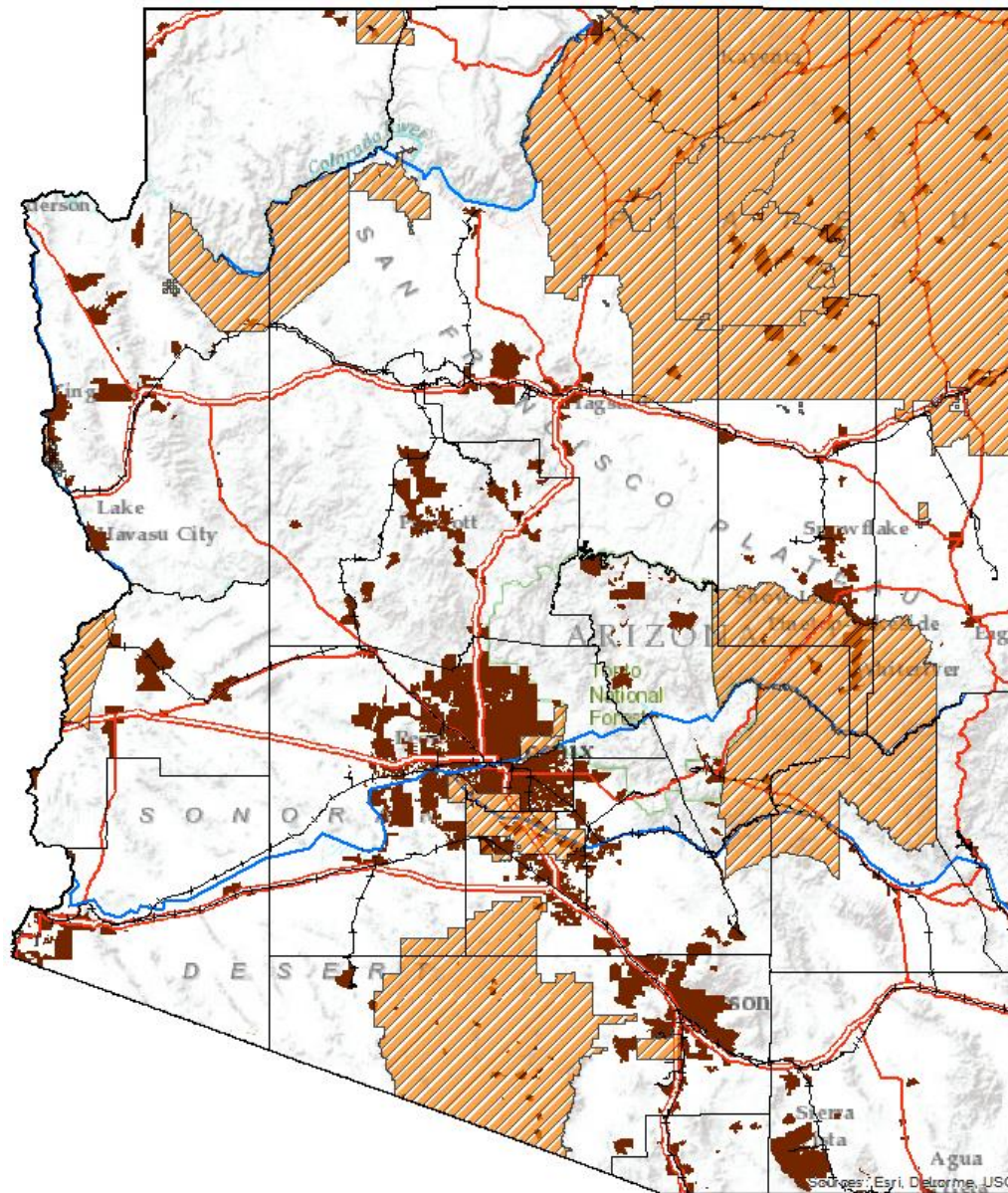


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# Boundaries & Roads

-  State
-  Counties
-  Federally-Recognized Tribes
-  USA Railroads
-  USA Major Rivers
-  Census Designated Places
- National Highway Network**
  -  Interstate
  -  US Highway



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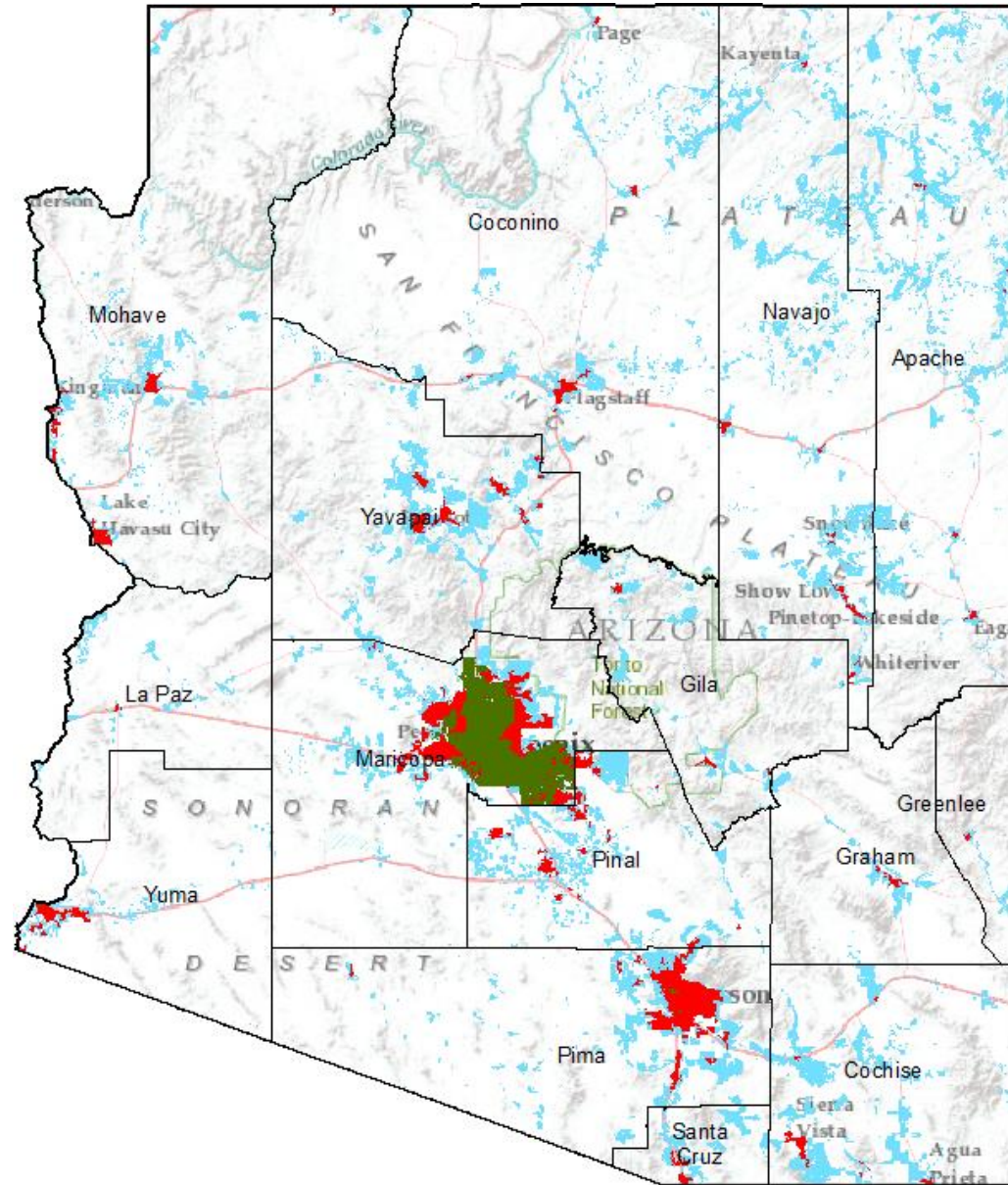
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# Population Density

## Population Density

- Population Density 2,500+ ppsqmi
- Urban Areas & Clusters (1,000+ ppsqmi)
- Population Density 5+ ppsqmi



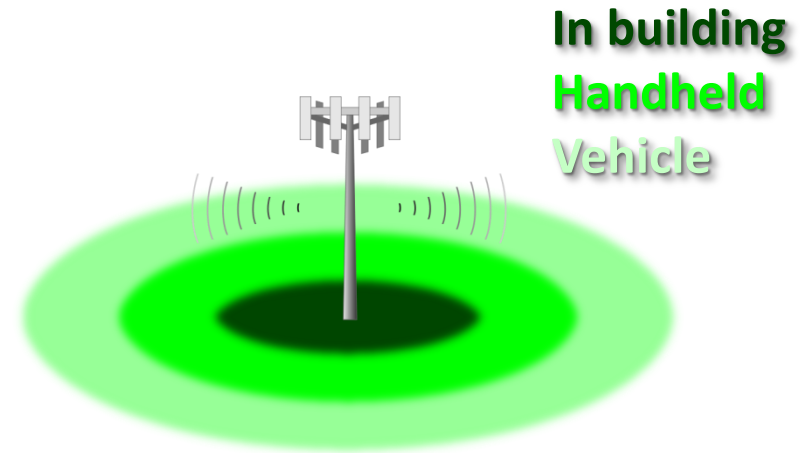
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# Translating Data to Coverage Levels

# Coverage Objective Levels

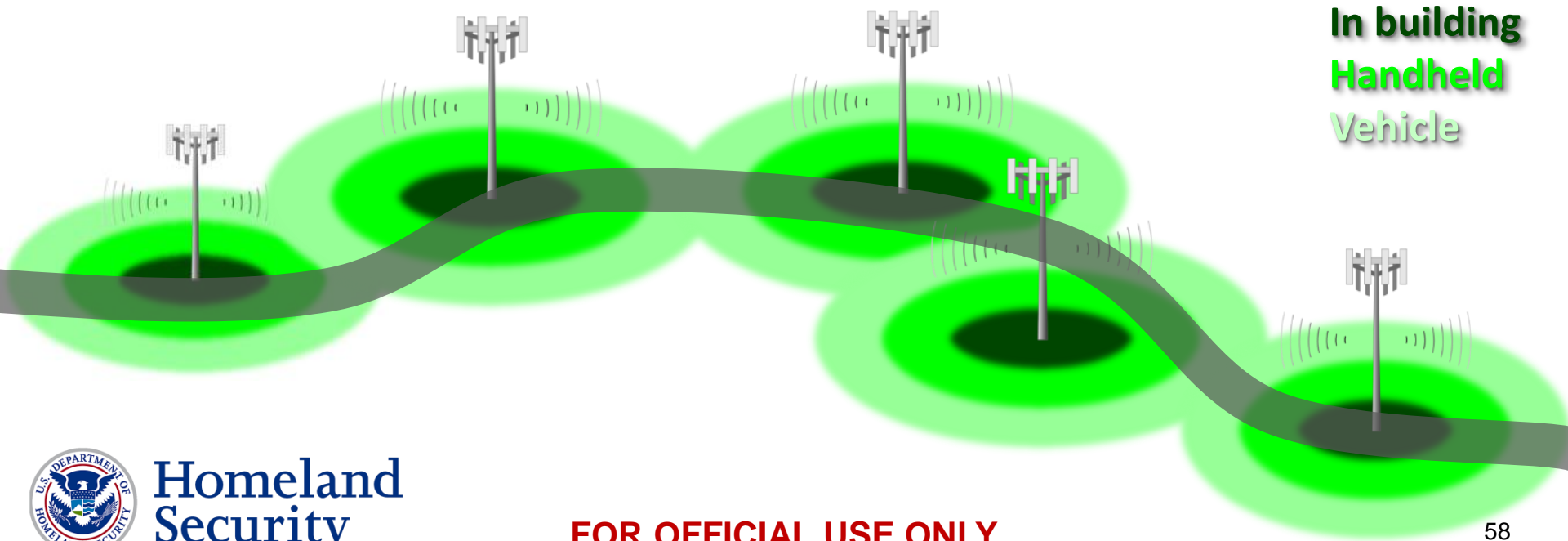
- Coverage objective levels (**in-building**, **handheld**, **vehicle**, etc.) does not mean that coverage will only be provided at that level
- It means that level of coverage will be provided reliably and at a minimum data rate
- A lower reliability and/or minimum data rate would result in greater coverage from the same site
- Service could extend beyond this but at a lower data rate



# Coverage Objective vs. Coverage Map

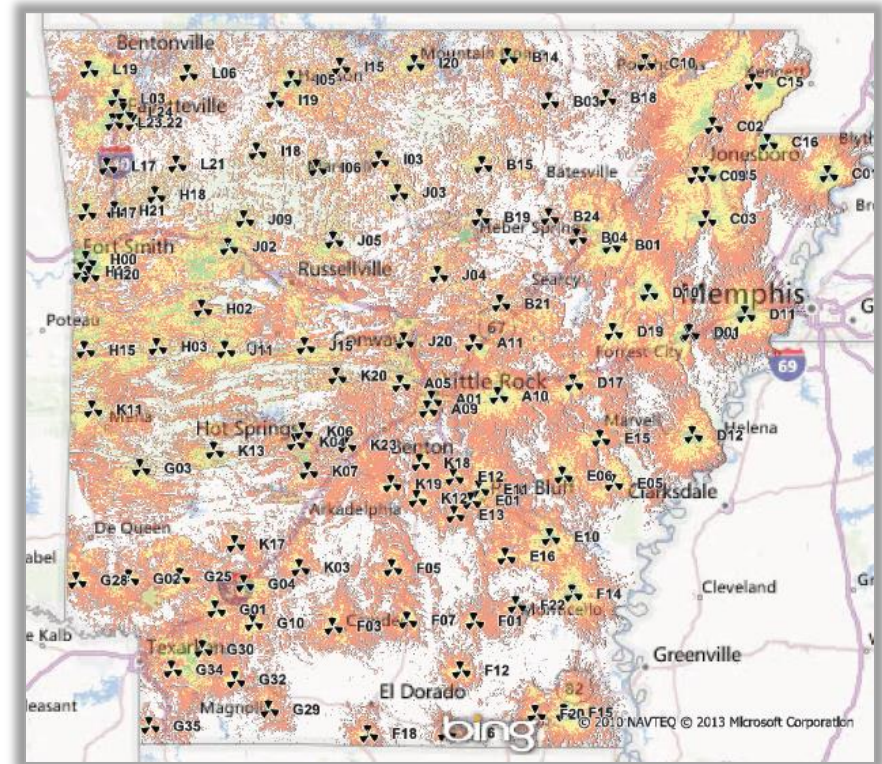
- **Coverage objectives** identify the State's coverage goals
- **Coverage maps** show predicted coverage for the network build out
- Once the towers are selected to satisfy the coverage objectives, the resulting coverage map may yield greater coverage.

*Highway example: The coverage objective is to provide mobile coverage on the highway. The resulting coverage will be much greater.*



# LTE Coverage – Varying Levels of Performance

- Performance can vary greatly based on signal strength
- Stronger signal results in higher throughput
  - Shown by different colors surrounding each site
  - System will adjust automatically
- Thus coverage is defined by throughput thresholds



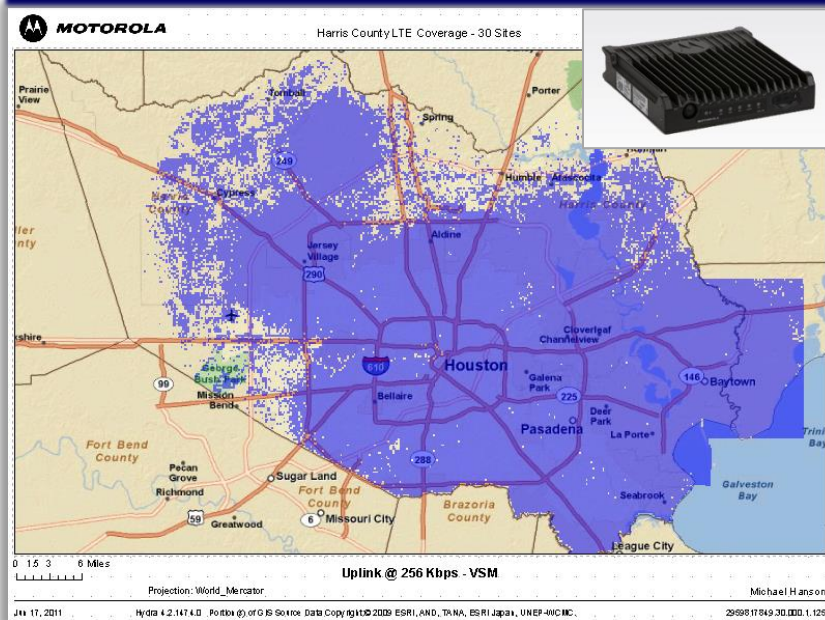
*Example plot from old coverage prediction provided simply to illustrate point*



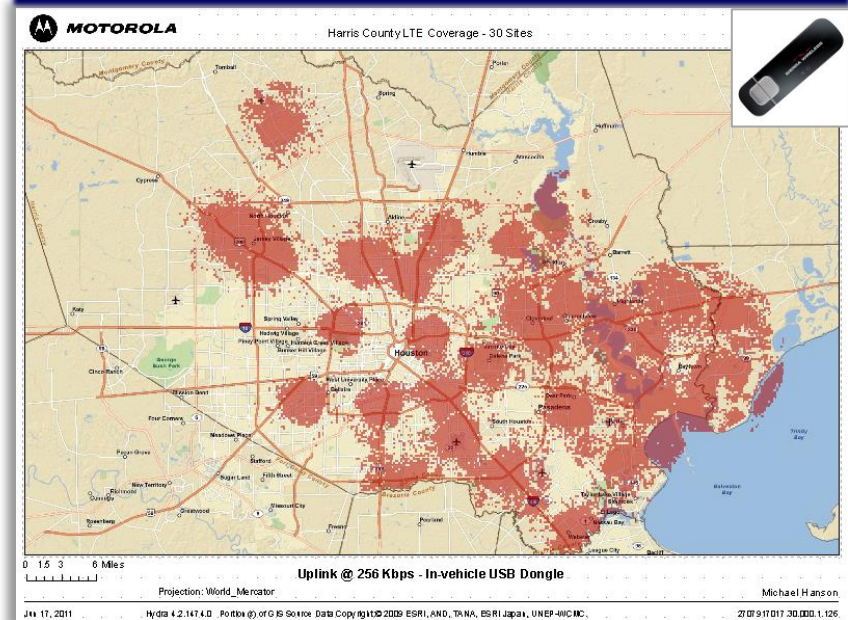
# LTE Coverage: Device Type Comparison

- Like portable vs. mobile LMR radios, different LTE device types will have different performances

## Vehicular modem



## USB dongle



*Example plots from old coverage predictions provided simply for comparison purposes.*



# OEC Baseline

The following is OEC's proposed approach to coverage levels, NOT FirstNet's requirements.

**In-Building Handheld Coverage:** Coverage provided to a handheld device through minimum one wall

- ***OEC Starting Point*** – Urban Areas and Clusters (1,000 people per square mile) as defined by US Census

**Handheld / Partial In-Building Coverage:** Coverage provided to a device outdoors or “on the street” including some in-building coverage

- ***OEC Starting Point*** – Outside of Urban Areas and Clusters, Census Designated Places (CDPs) with more than 500 people

**Vehicular Modem / Partial Handheld Coverage:** Vehicle-based user equipment, as well as some handheld coverage

- ***OEC Starting Point*** – Interstates, major U.S. highways and non-CDP areas with more than 5 people per square mile (using census blocks)

**Satellite / Deployable Coverage:** Outside of fixed terrestrial coverage; mobile or satellite connectivity only

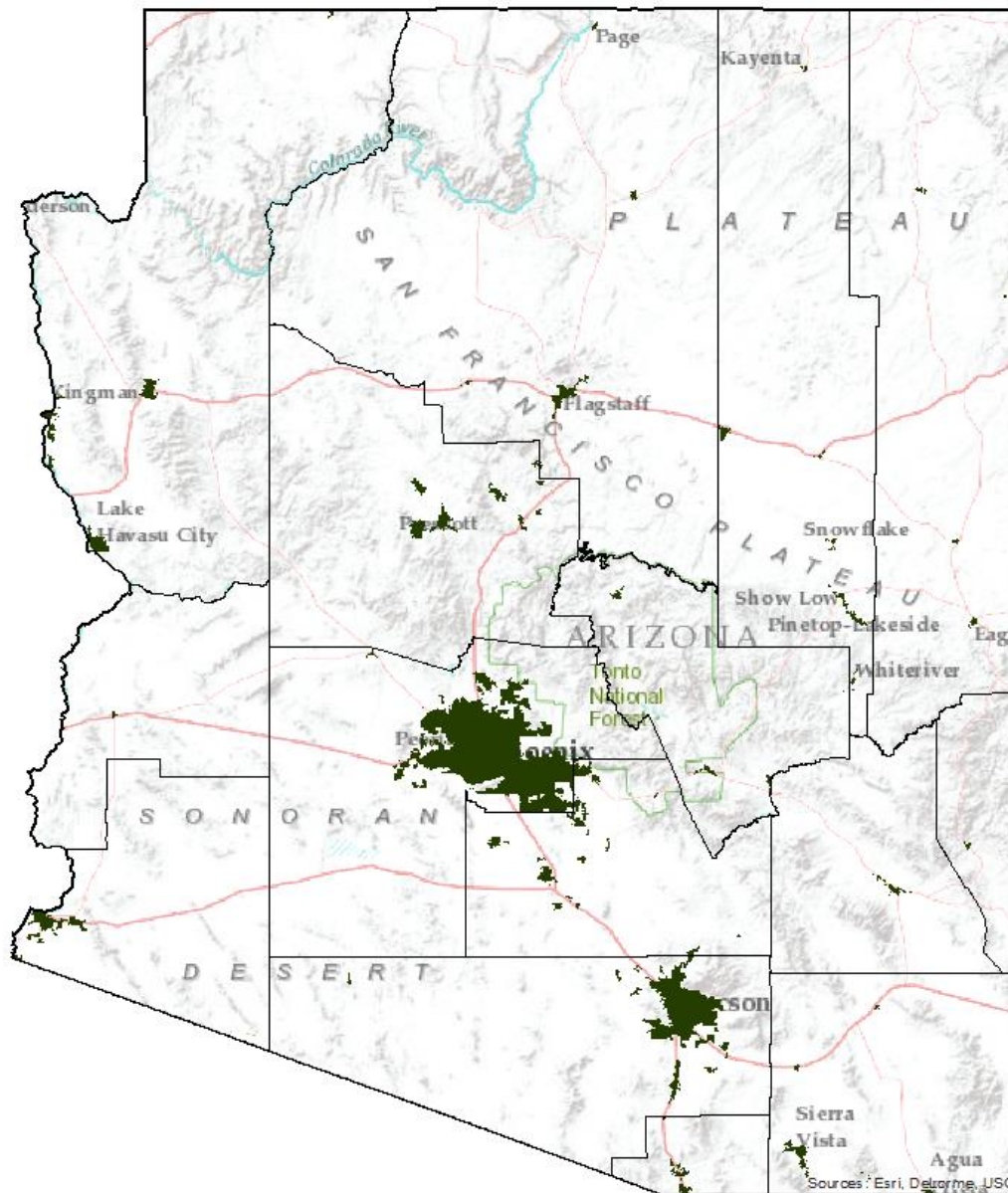
- ***OEC Starting Point*** – All areas with less than 5 people per square mile

# In-Building Coverage

## OEC Starting Point

Urban Areas and Clusters  
(1,000 people per square  
mile) as defined by US  
Census Bureau

■ In-Building



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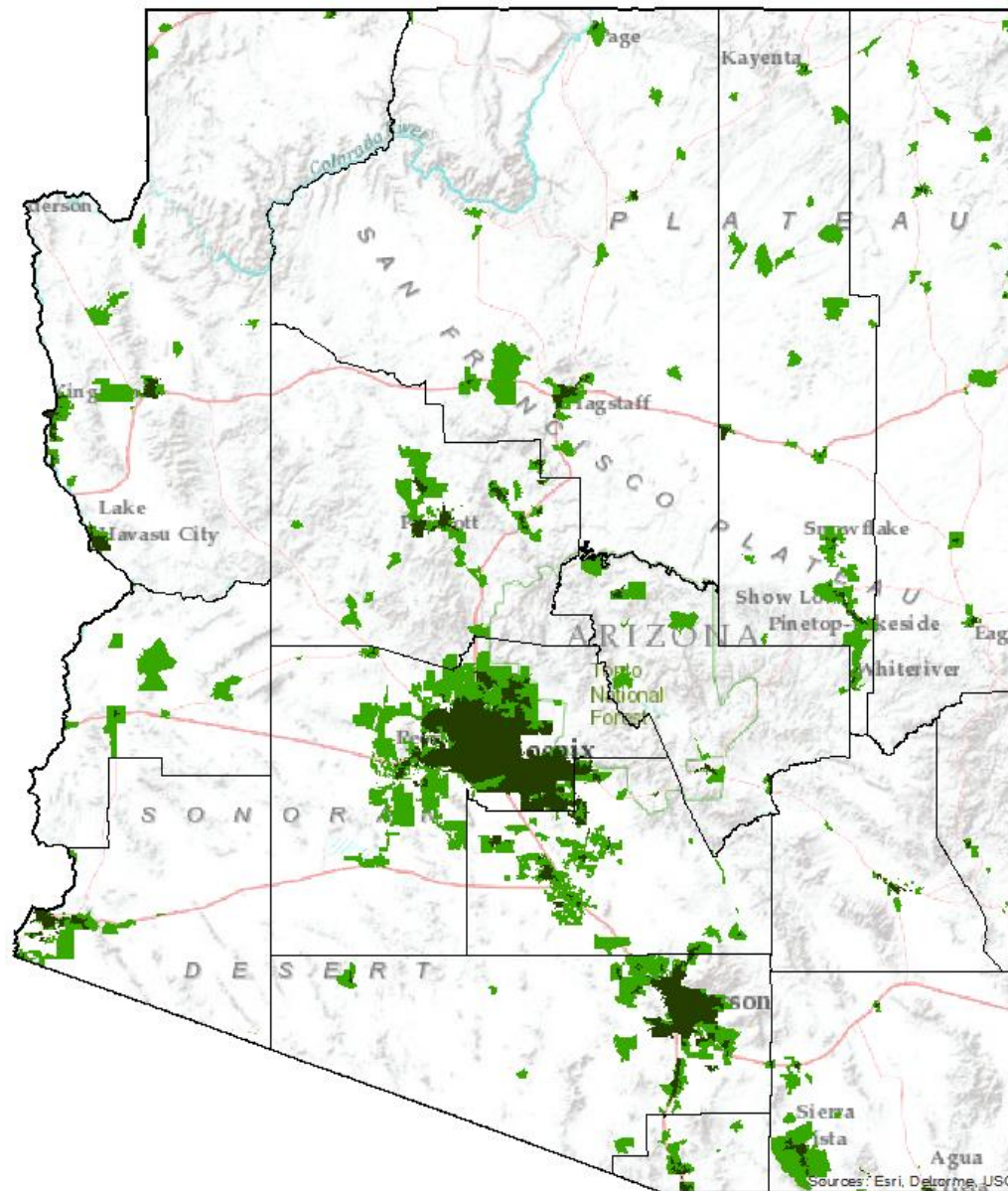
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# Handheld Coverage

## OEC Starting Point

Outside of Urban Areas  
and Clusters, Census  
Designated Places (CDPs)  
with more than 500 people

-  In-Building
-  Handheld/Partial In-Building



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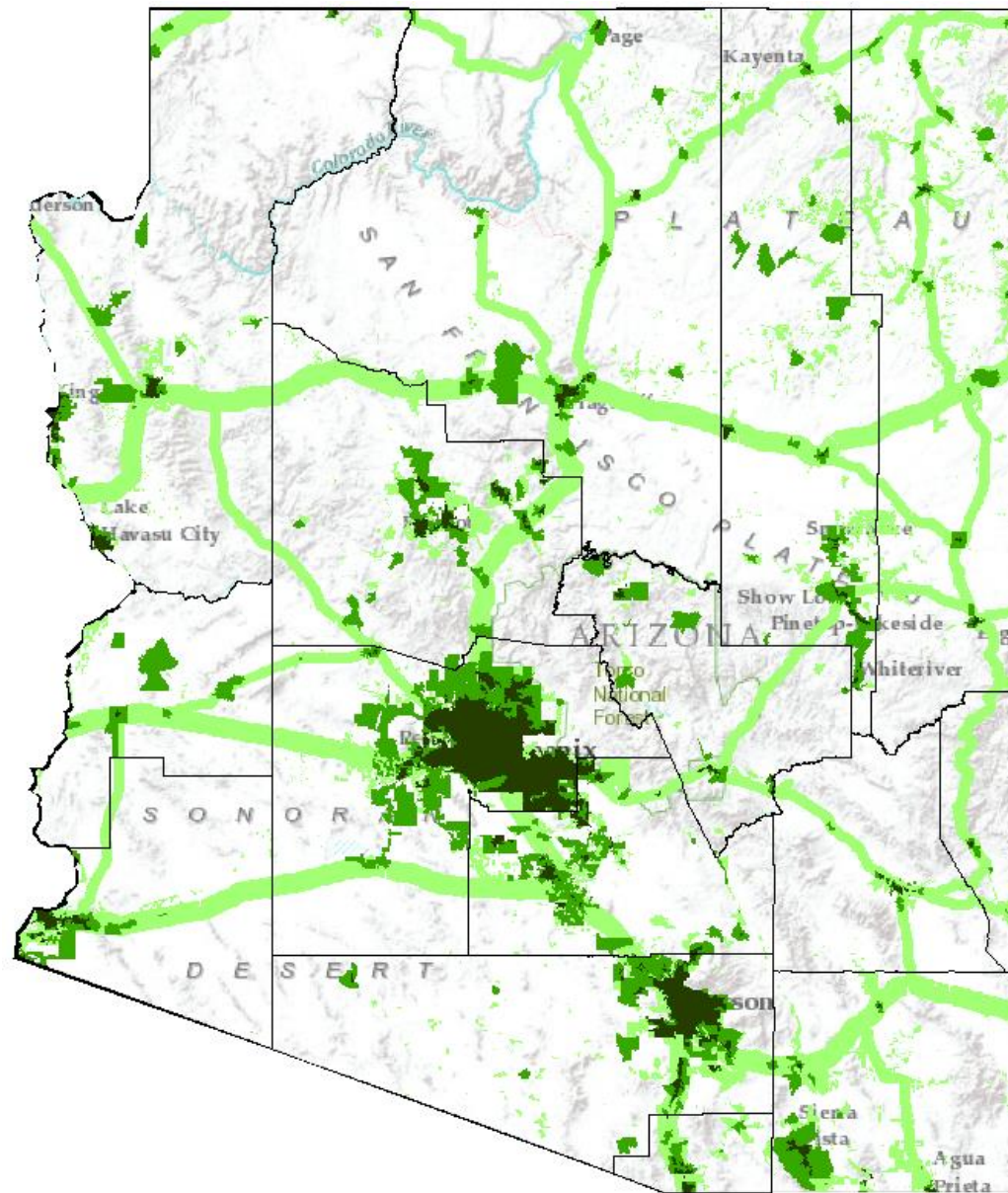
# All Coverage

## OEC Starting Point

Interstates, major U.S. highways and non-CDP areas with more than 5 people per square mile (using census blocks)

All other areas would use Satellite/ Deployable coverage.

-  **In-Building**
-  **Handheld/Partial In-Building**
-  **Vehicular Modem/ Partial handheld**
-  **Satellite/Deployable**



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# **Adjusting the Baseline Based on Public Safety's Need**











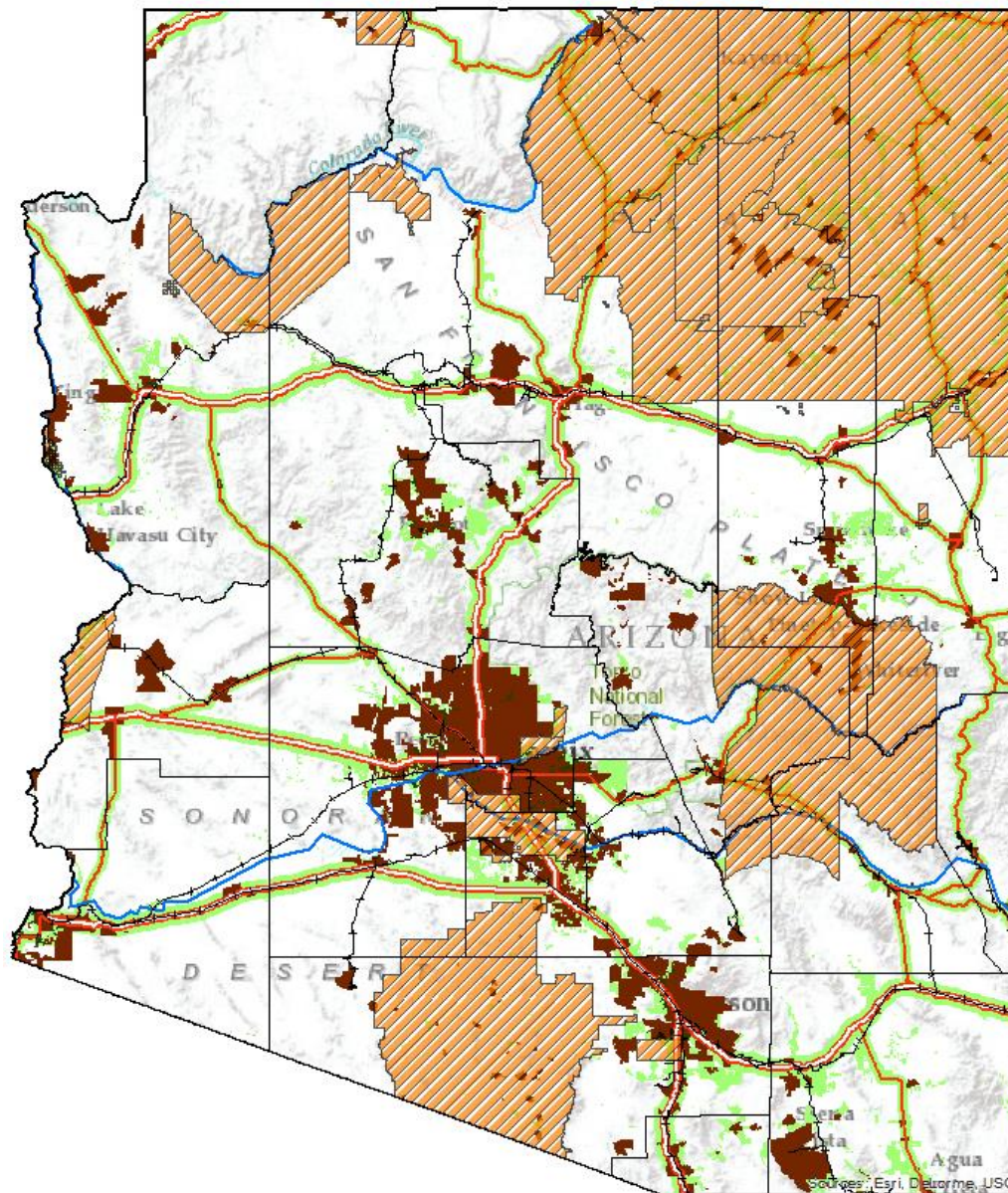
# Homeland Security





# Boundaries and Roads

-  State
-  Counties
-  Federally-Recognized Tribes
-  USA Railroads
-  USA Major Rivers
-  Census Designated Places
- National Highway Network**
  -  Interstate
  -  US Highway



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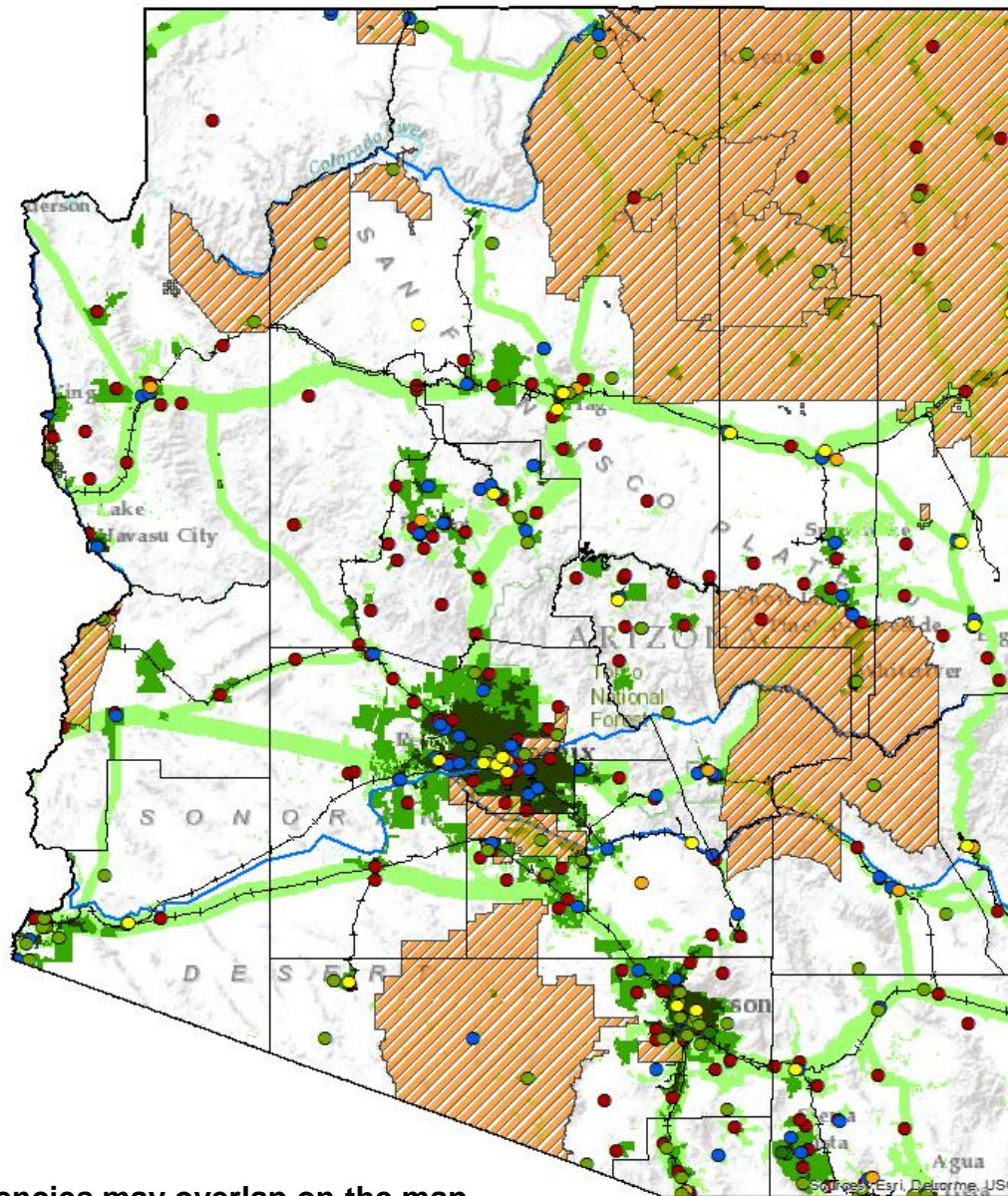
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# Agencies

## Agencies

- EMS Departments
- Federal
- Military
- Emergency Management
- Law Enforcement
- Fire Departments



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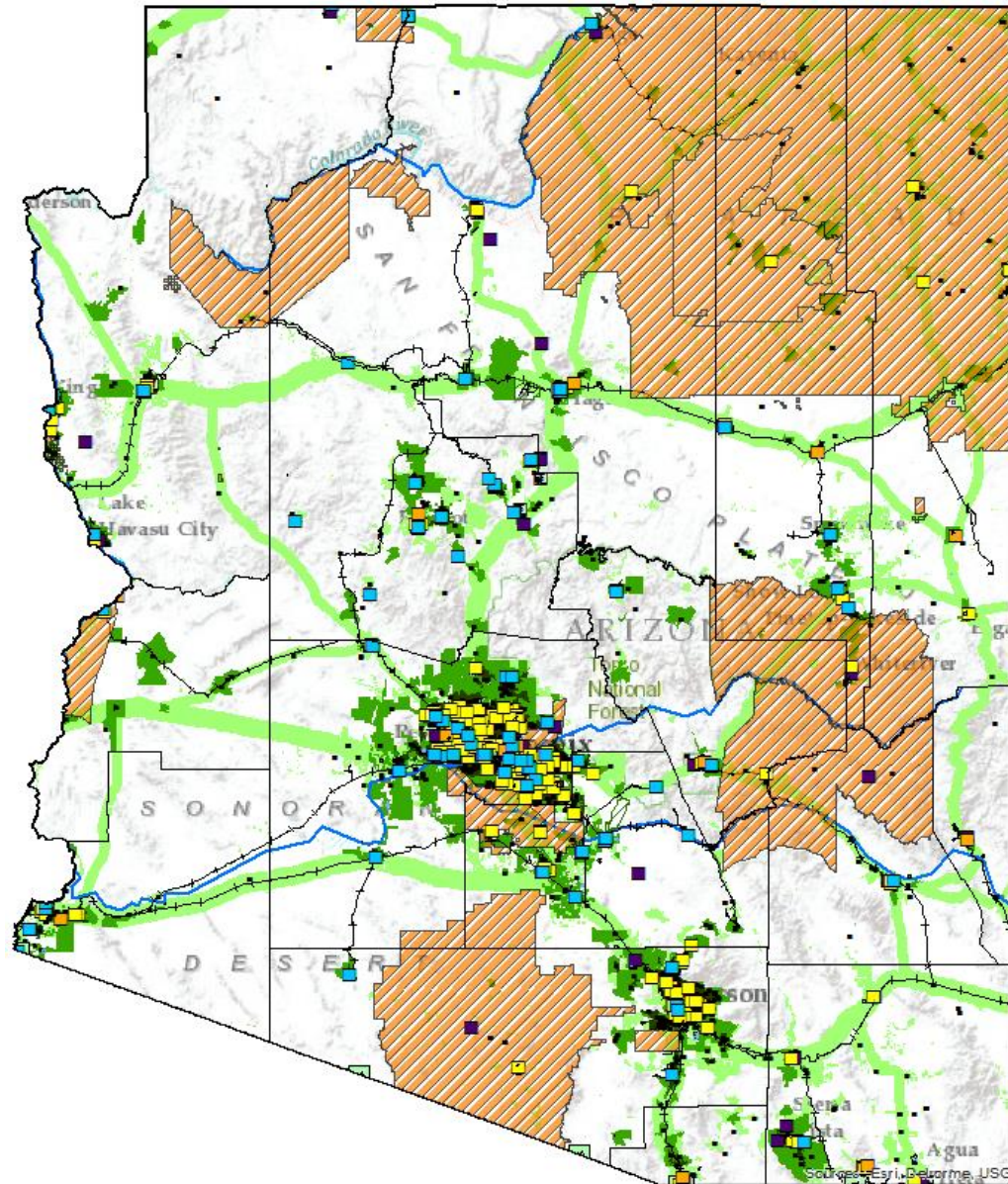
\*Several agencies may overlap on the map  
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# Facilities

## Facilities

- Major State Government Building
- Court Houses
- ▨ Prison Areas
- Corrections
- ▨ Airport
- ✈ Airports
- Local Emergency Operations Centers
- State Emergency Operation Centers
- Urgent Care Facilities
- Hospitals
- PSAP
- Schools
- ± Ports
- Amtrak Stations
- Air National Guard (ANG) Sites
- ▨ Army National Guard (ARNG) Installations
- Canada and Mexico Border Crossings



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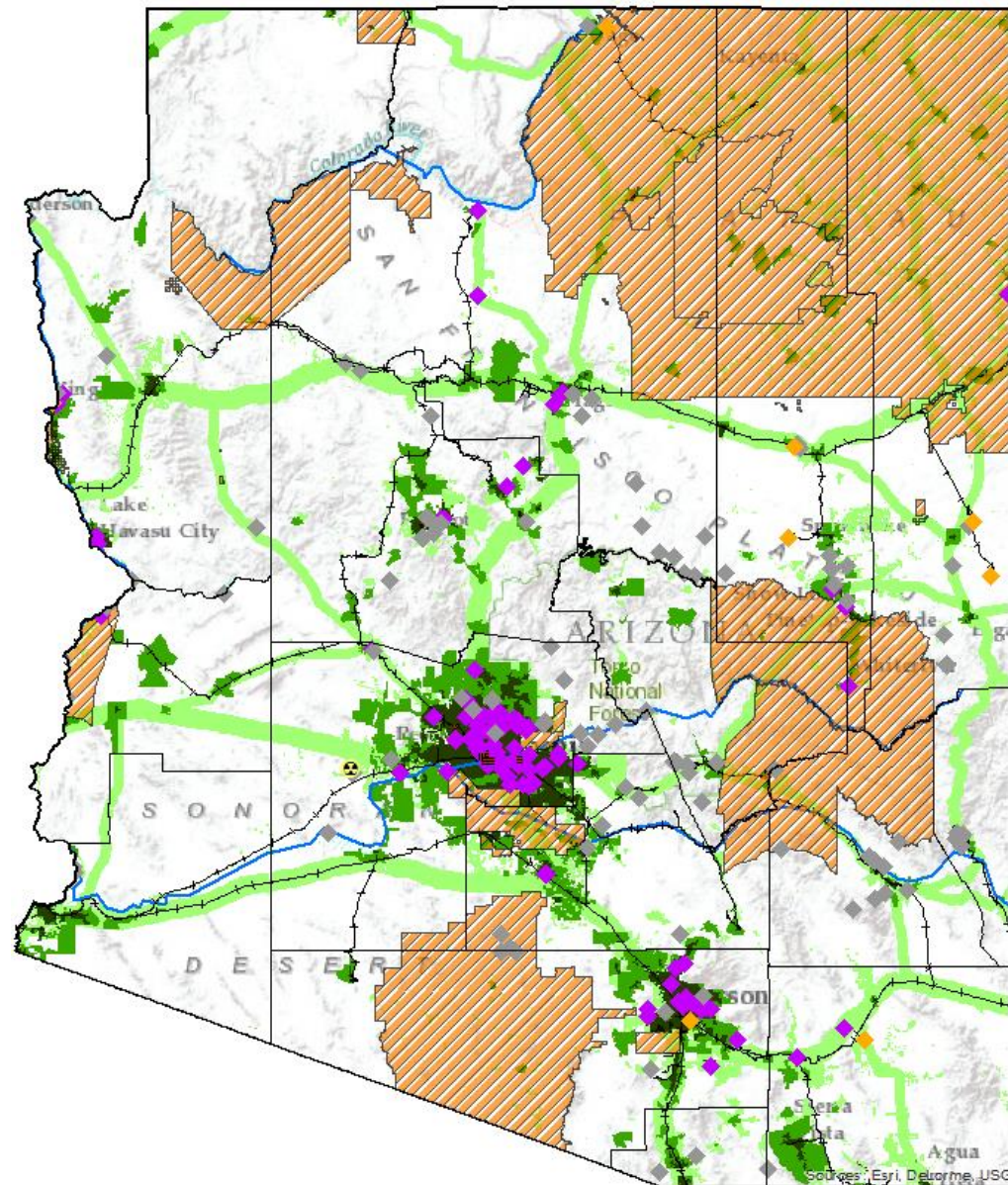
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# Critical Infrastructure

## Critical Infrastructure

- ◆ Manufacturing
- Hazardous Materials Routes
- ◆ Energy
- ☢ Nuclear Plants
- ◆ Dams
- ◆ Public Venues



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# Agencies / Facilities / Critical Infrastructure

## Agencies

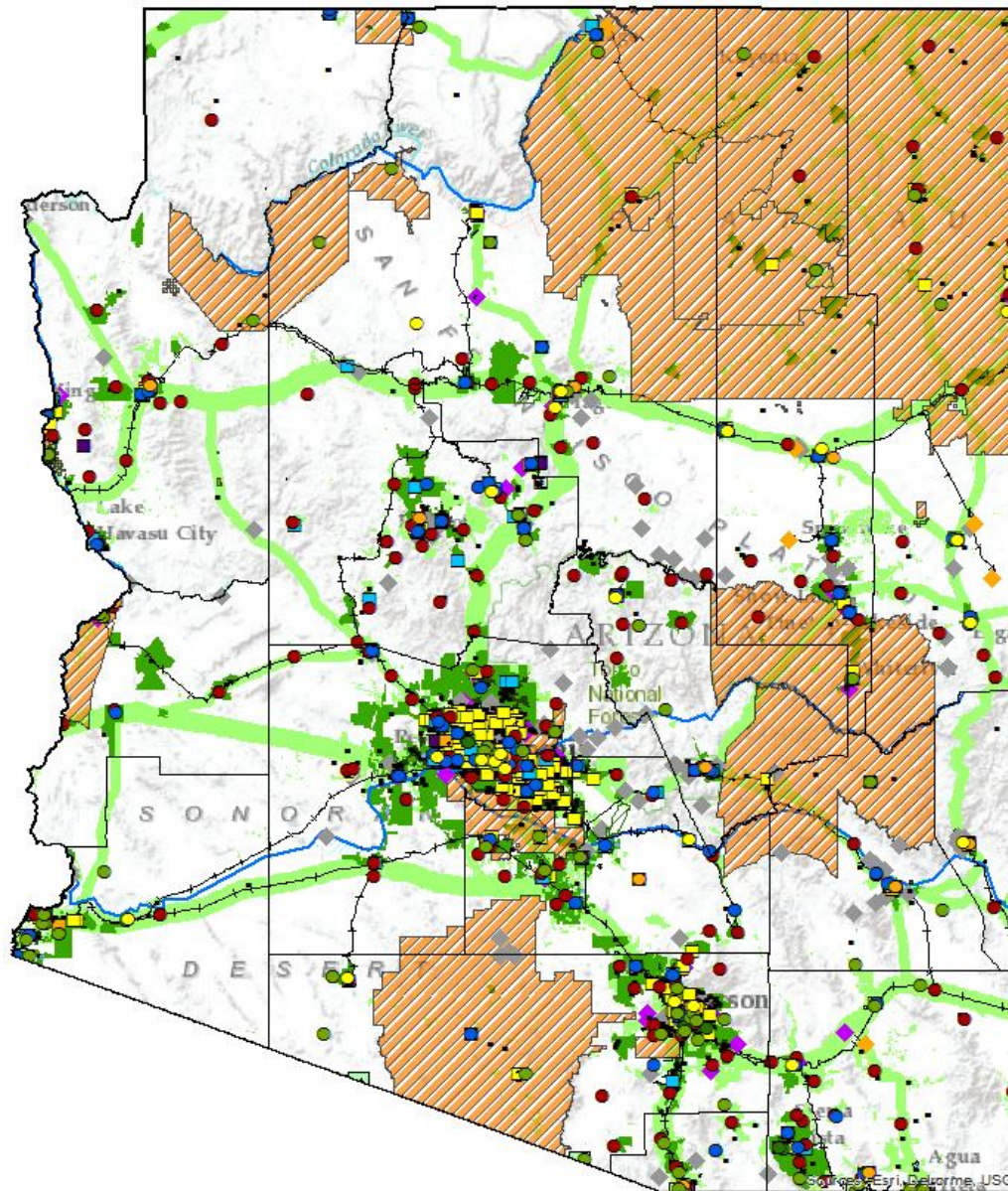
- EMS Departments
- Federal
- Military
- Emergency Management
- Law Enforcement
- Fire Departments

## Facilities

- Major State Government Building
- Court Houses
- ▨ Prison Areas
- ▨ Corrections
- ▨ Airport
- ✈ Airports
- Local Emergency Operations Centers
- State Emergency Operation Centers
- Urgent Care Facilities
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- Schools
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- Amtrak Stations
- Air National Guard (ANG) Sites
- ▨ Army National Guard (ARNG) Installations
- Canada and Mexico Border Crossings

## Critical Infrastructure

- ◆ Manufacturing
- Hazardous Materials Routes
- ◆ Energy
- ◆ Nuclear Plants
- ◆ Dams
- ◆ Public Venues







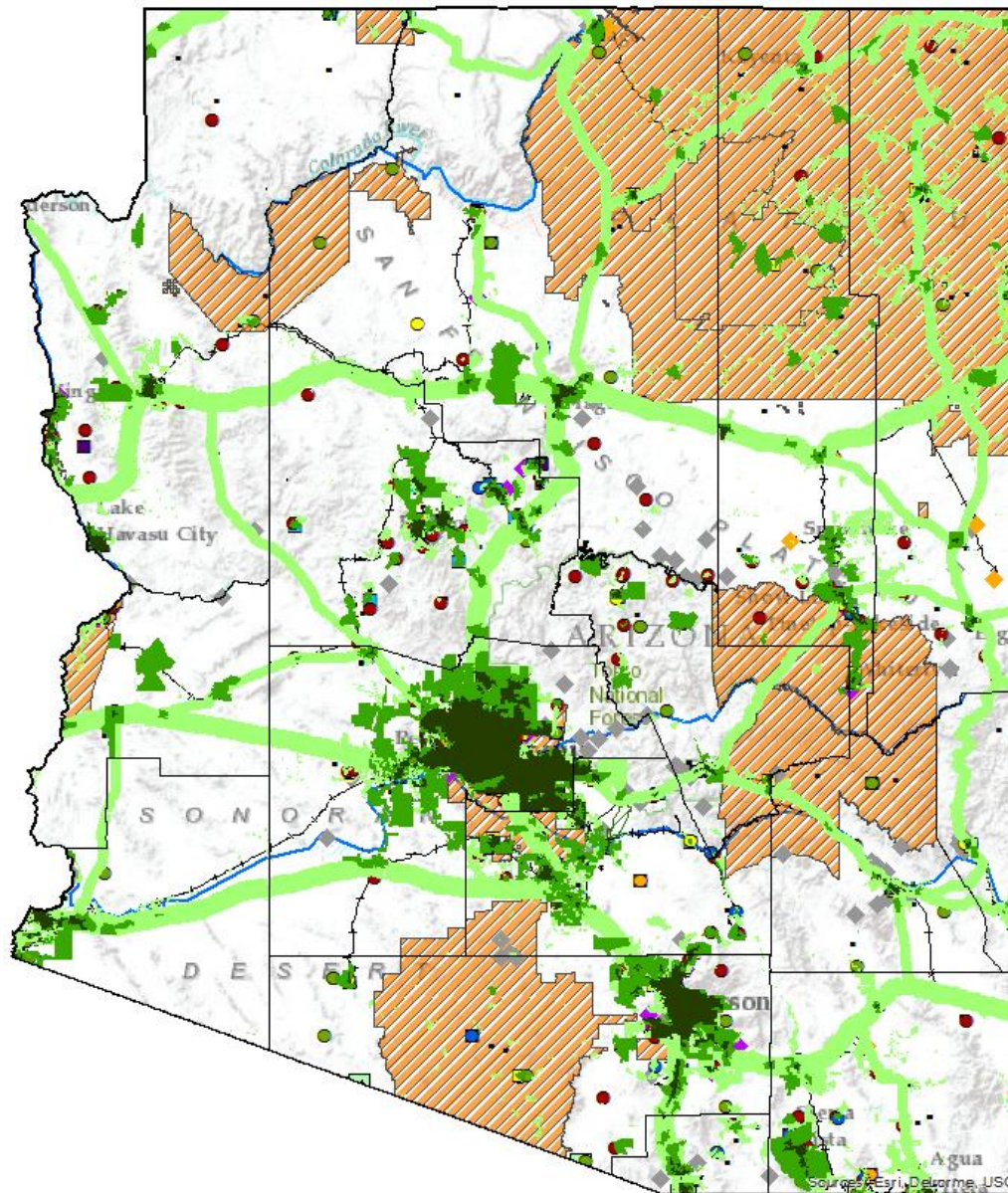
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# All Coverage Levels

-  In-Building
-  Handheld/Partial In-Building
-  Vehicular Modem/Partial handheld
-  Satellite/Deployable







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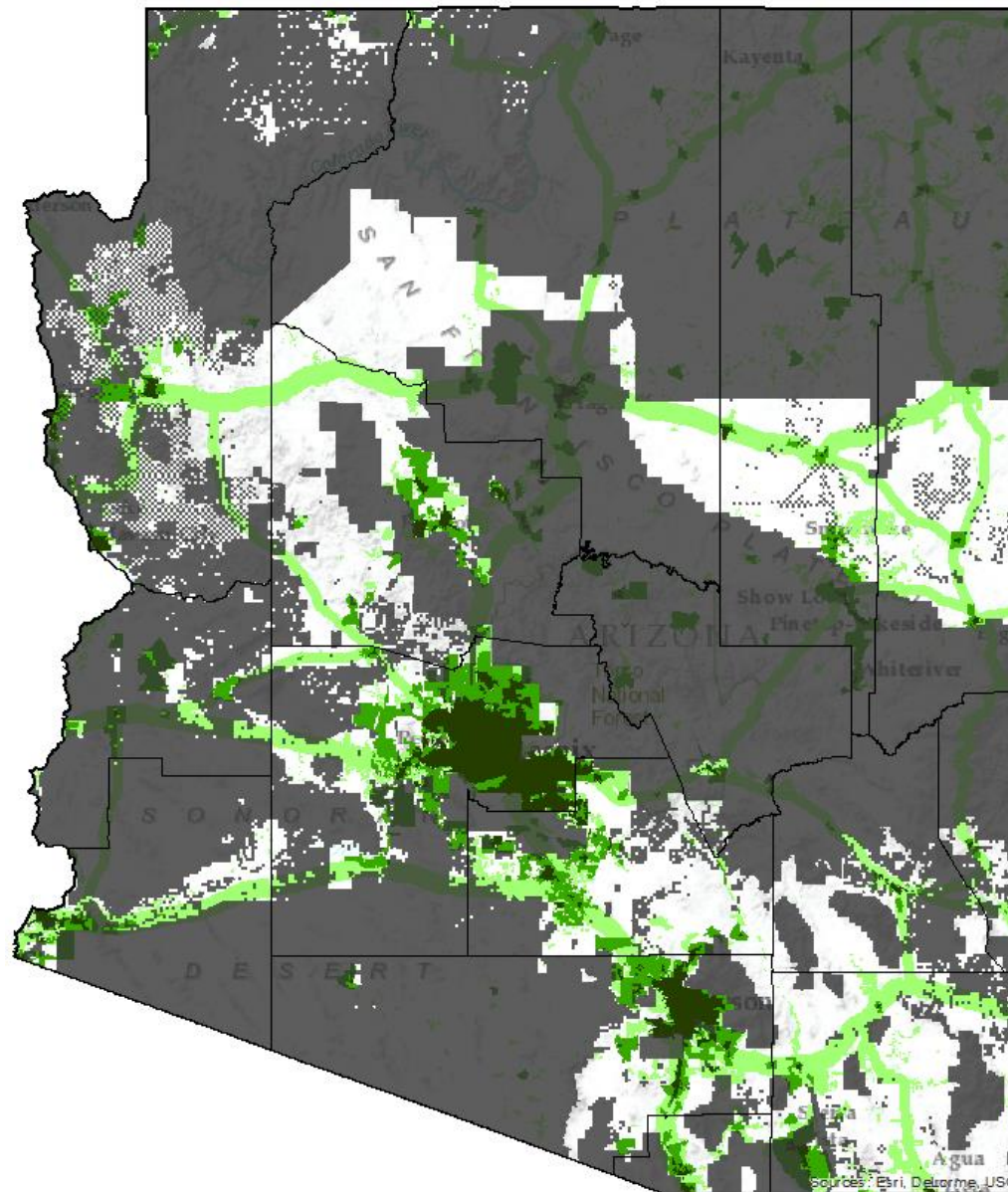
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# Coverage with Federal Overlay

This map shows the proposed coverage levels with the Federal Lands in the State.

## How do Federal Lands affect the State's Coverage Objectives?





-  **In-Building**
-  **Handheld/Partial In-Building**
-  **Vehicular Modem/Partial handheld**
-  **Satellite/Deployable**

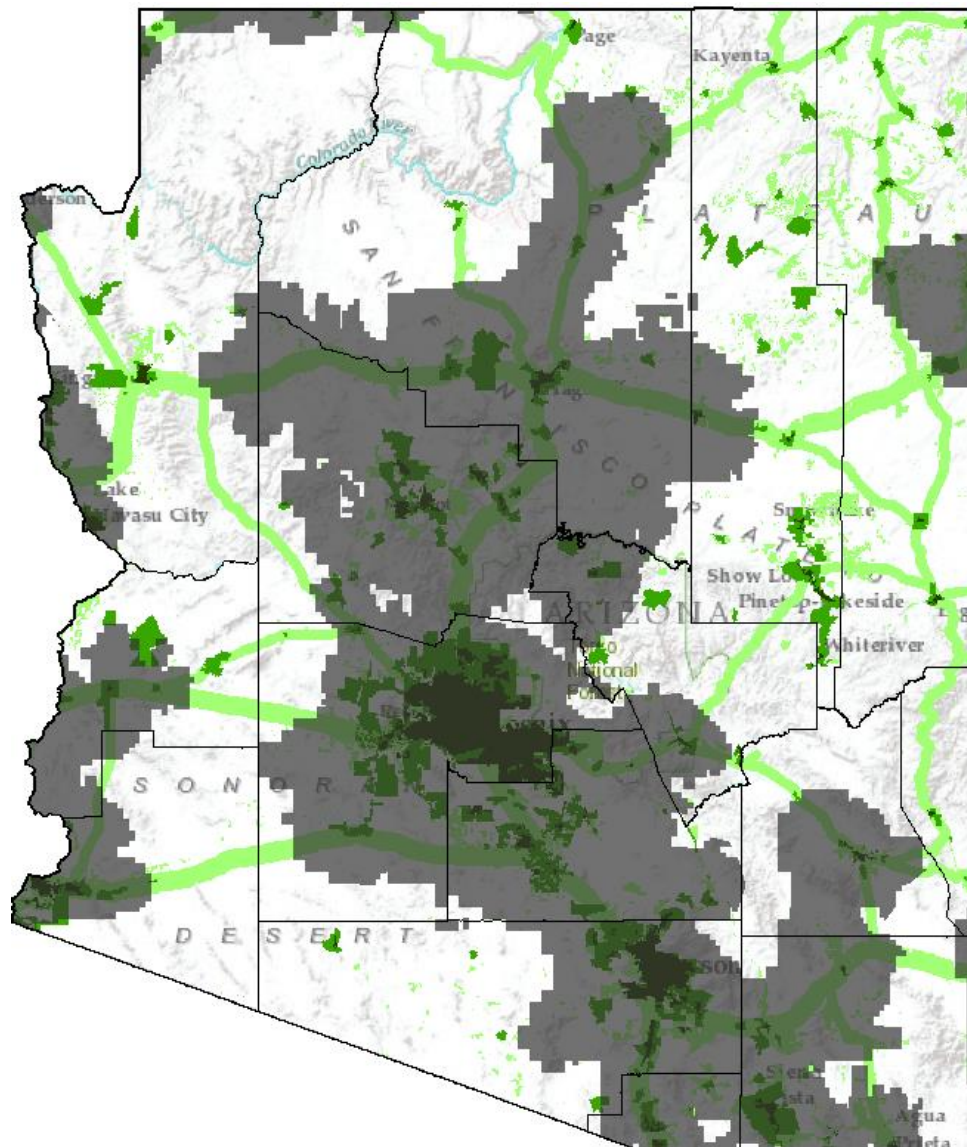




# Coverage with LTE Overlay





This map illustrates advertised Commercial LTE coverage. Providers include: AT&T, Verizon, Sprint, and T-Mobile.

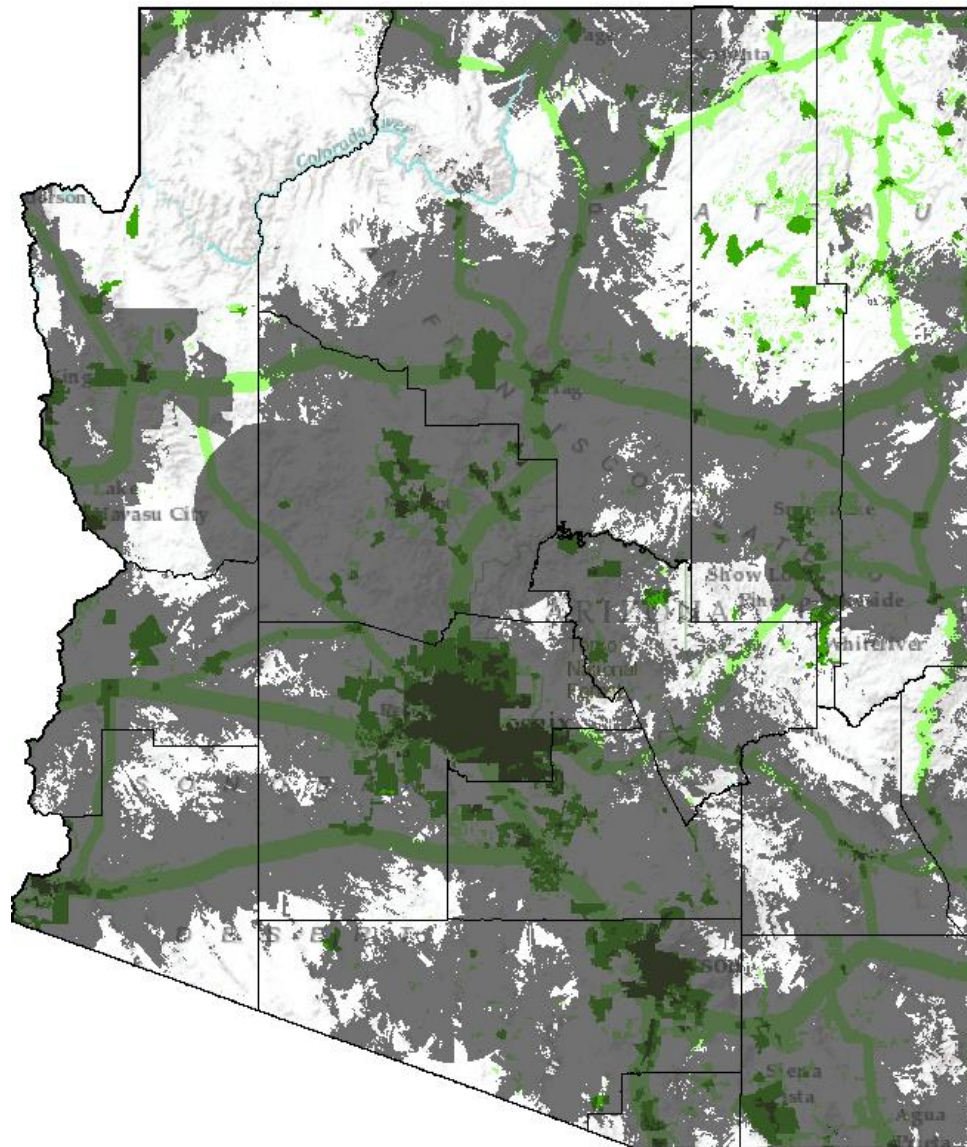
-  **In-Building**
-  **Handheld/Partial In-Building**
-  **Vehicular Modem/ Partial handheld**
-  **Satellite/Deployable**



# Commercial Provider Overlay

This is a map of advertised Commercial 2G, 3G, and 4G service. Providers include: AT&T, Verizon, Sprint, T-Mobile, U.S. Cellular, and other regional carriers.

-  **In-Building**
-  **Handheld/Partial In-Building**
-  **Vehicular Modem/Partial handheld**
-  **Satellite/Deployable**



# Arizona Baseline

*What are the State's objectives for each of the following coverage levels?*

**In-Building Handheld Coverage:** Coverage provided to a handheld device through minimum one wall

*Buildings where data communications is critical, schools, critical infrastructure, and public venues. GIS and CAD data may be helpful in identifying this requirement.*

**Handheld / Partial In-Building Coverage:** Coverage provided to a device outdoors or “on the street” including some in-building coverage

*Areas where personnel will be using a portable device such as public venues, buildings and other facilities in suburban and rural areas. GIS and CAD data may be helpful in identifying this requirement.*

**Vehicular Modem / Partial Handheld Coverage:** Vehicle-based user equipment, as well as some handheld coverage

*Rural areas of the State, evacuation routes, and special events.*





**Satellite / Deployable Coverage:** Outside of fixed terrestrial coverage, deployable, or satellite connectivity only

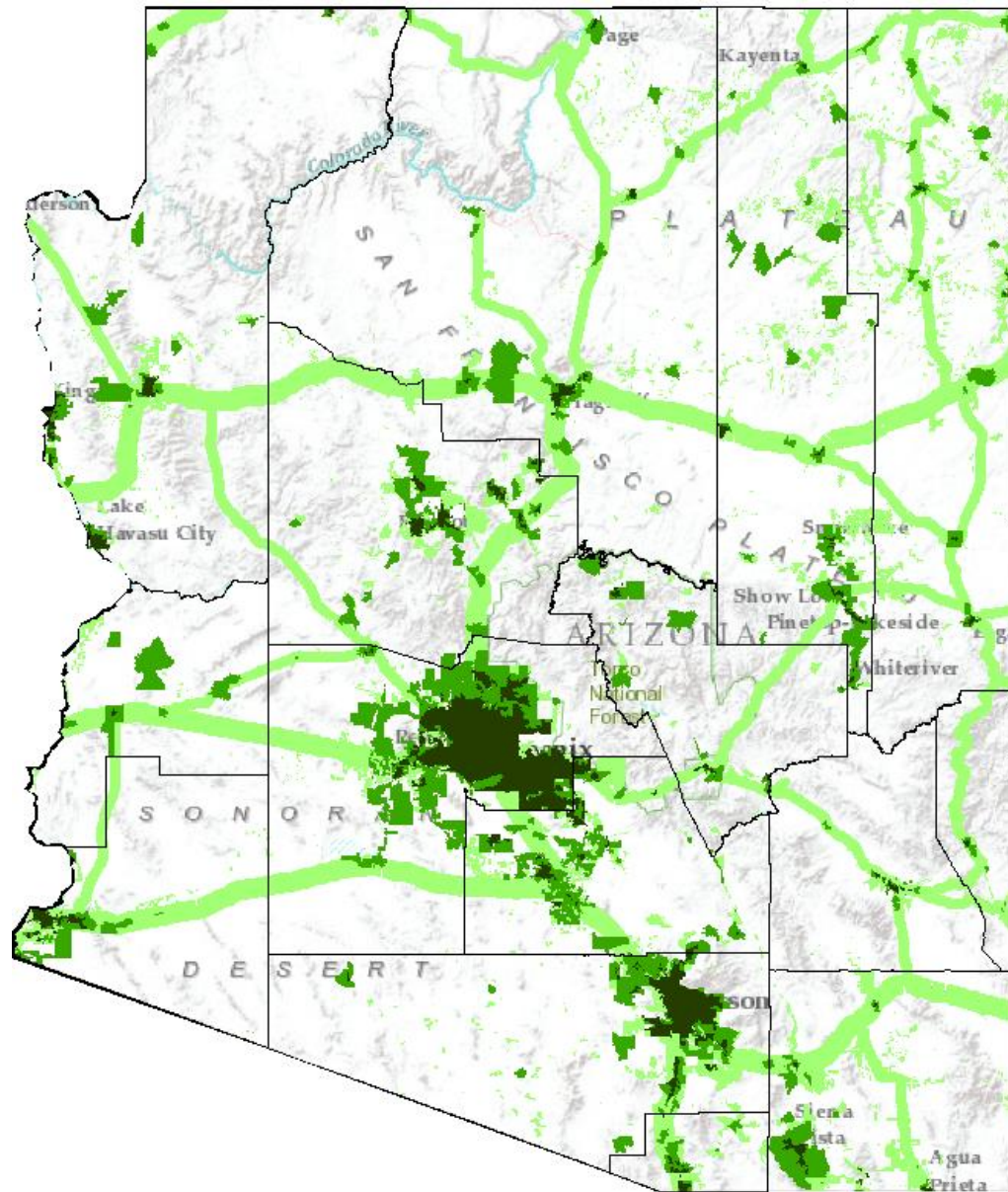
*Areas where there is currently minimal or no commercial coverage, and special events.*



# Example of Coverage Deliverable to FirstNet

**Deliverable to FirstNet:** GIS file broken down into the 4 coverage areas

-  **In-Building**
-  **Handheld/Partial In-Building**
-  **Vehicular Modem/Partial handheld**
-  **Satellite/Deployable**

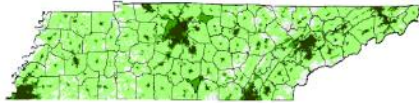


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# Identifying Users

# Focus on Users



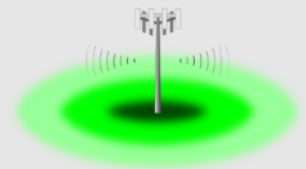
## Coverage

- Where is reliable Coverage needed?
- For what level/ device types?
- Using what potential methods?



## Capacity

- How many total users?
- What is their operational area?
- What type of applications do they use?



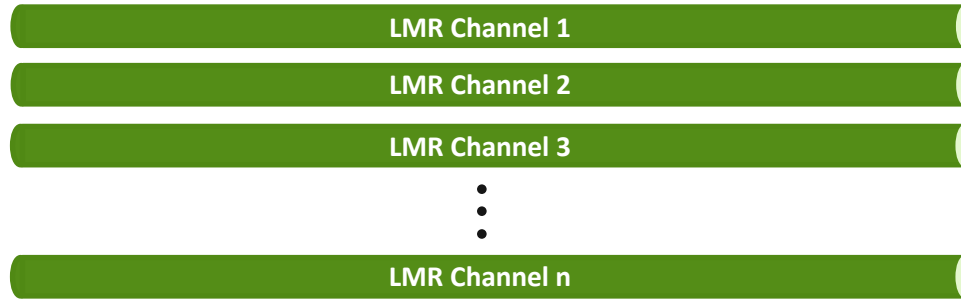
## RAN Design

- Estimated number of sites
- Initial cost estimate
- Parameters for asset data collection

# LMR vs. LTE Capacity



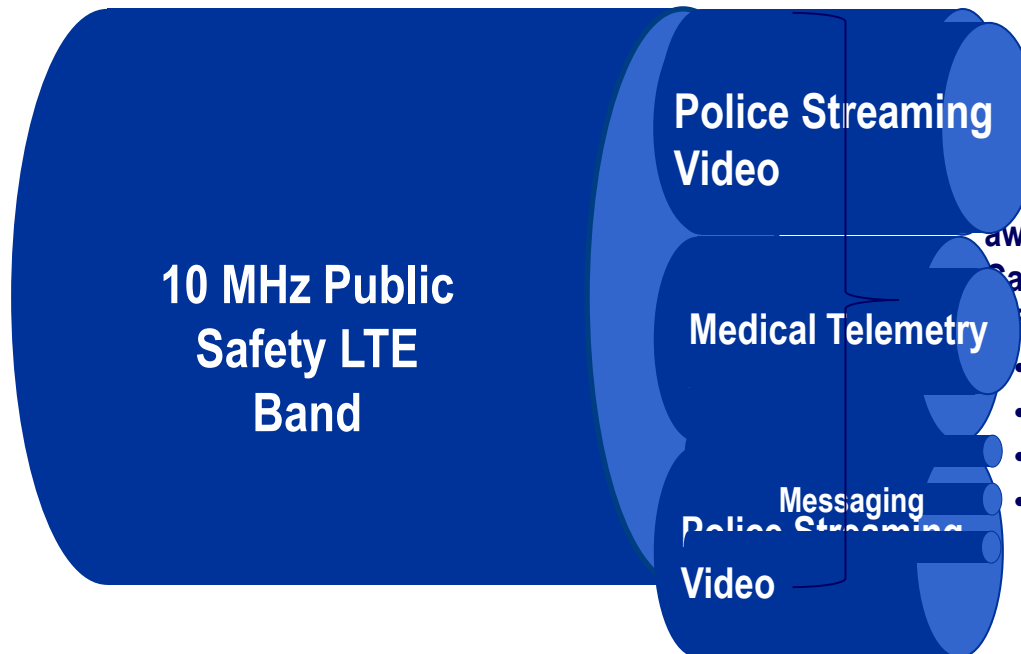
LMR Tx



Each channel supports a conversation



LTE Tx



Large Data Rate Demand for Available Throughput

For much as much as possible, must either:

- Lower resolution of one or more users
- Drop one (or more) users
- Stream at a lower rate
- Size of Pipe Shrinks When Channel Gets Noisy – Move Away from Cell Tower

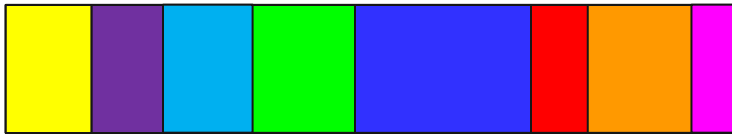


Variable Data Rate per User – 1 to 100 Simultaneous Users

# LMR vs. LTE Capacity, cont.

- LTE

- All sites (sectors) operate on same frequency thus overlapping coverage needs to be minimized
- “Channels” (slots) managed dynamically at each site
- Bandwidth determined by need and availability
- Number of users at a site can impact coverage



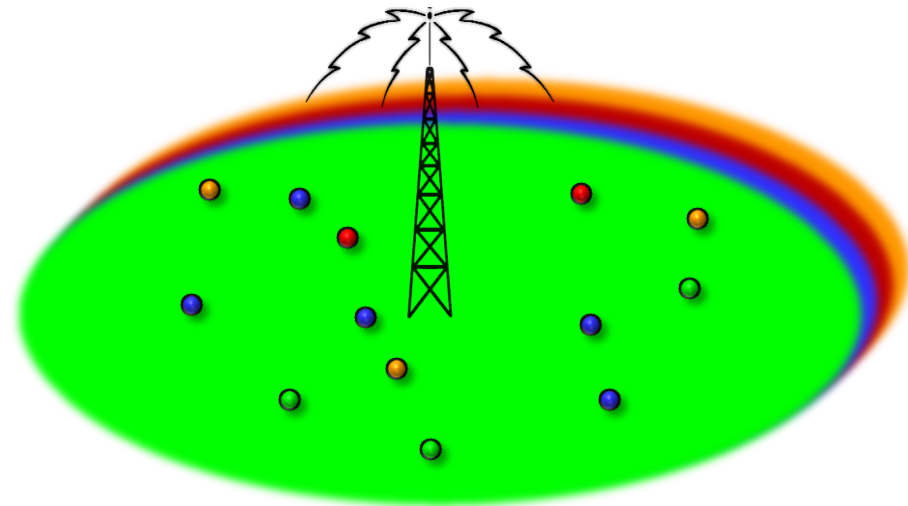
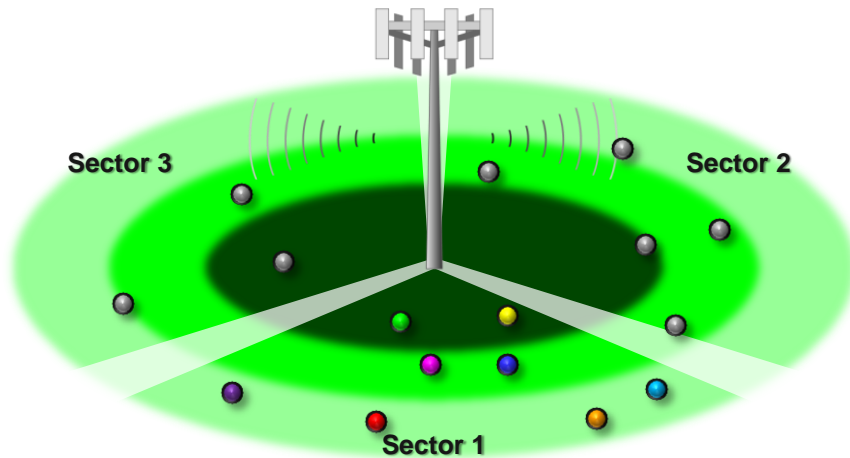
LTE Spectrum

- LMR

- Channels pre-configured per site
- Overlapping coverage using different frequency
- Fixed bandwidth / throughput per channel
- Users on one channel don't impact others



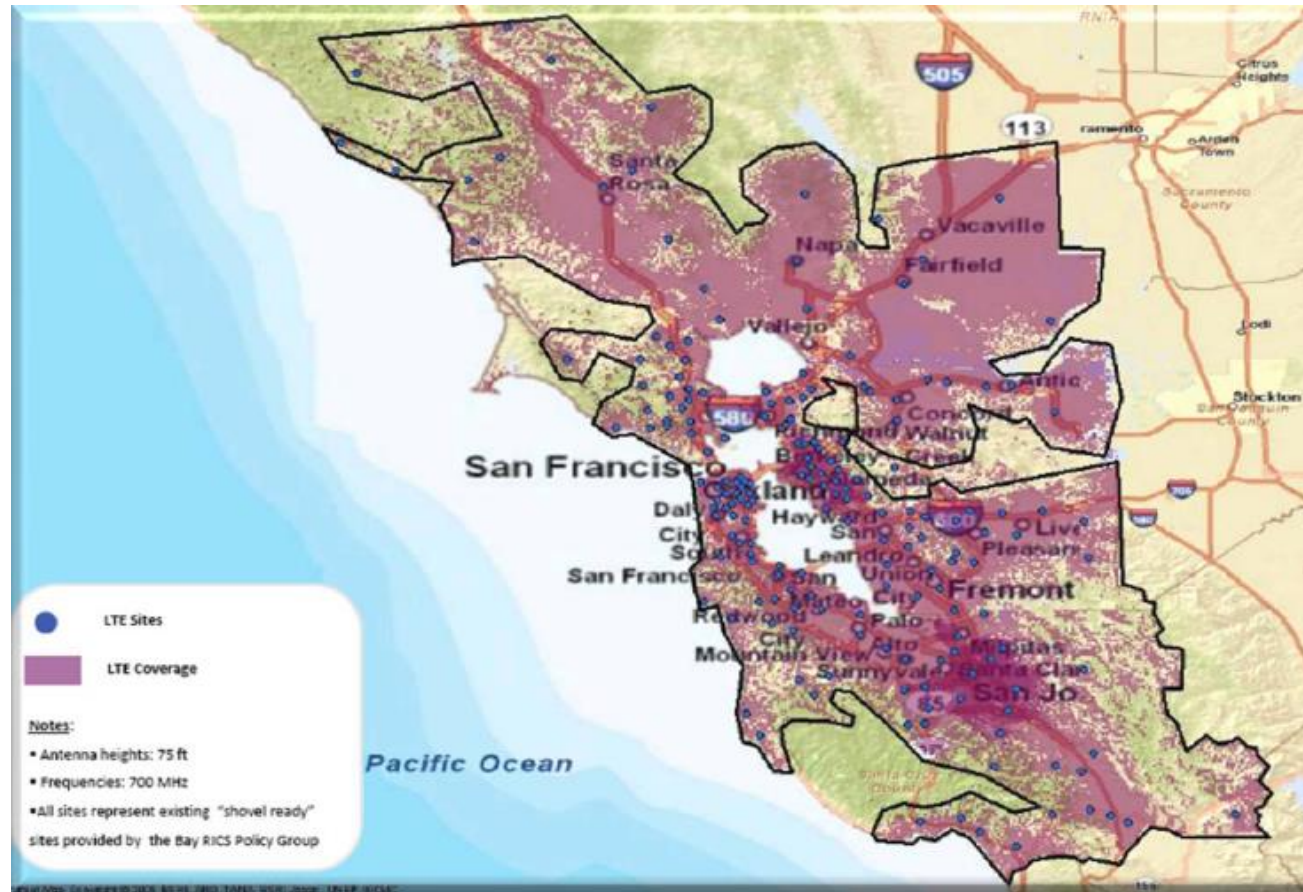
LMR Spectrum





# LTE Site Density

- **There will be a significant number of sites required to provide the network capacity in metro areas**
- **BayWEB Example shows high site density in San Francisco and Oakland area**



**Source: APCO Broadband Summit presentation**

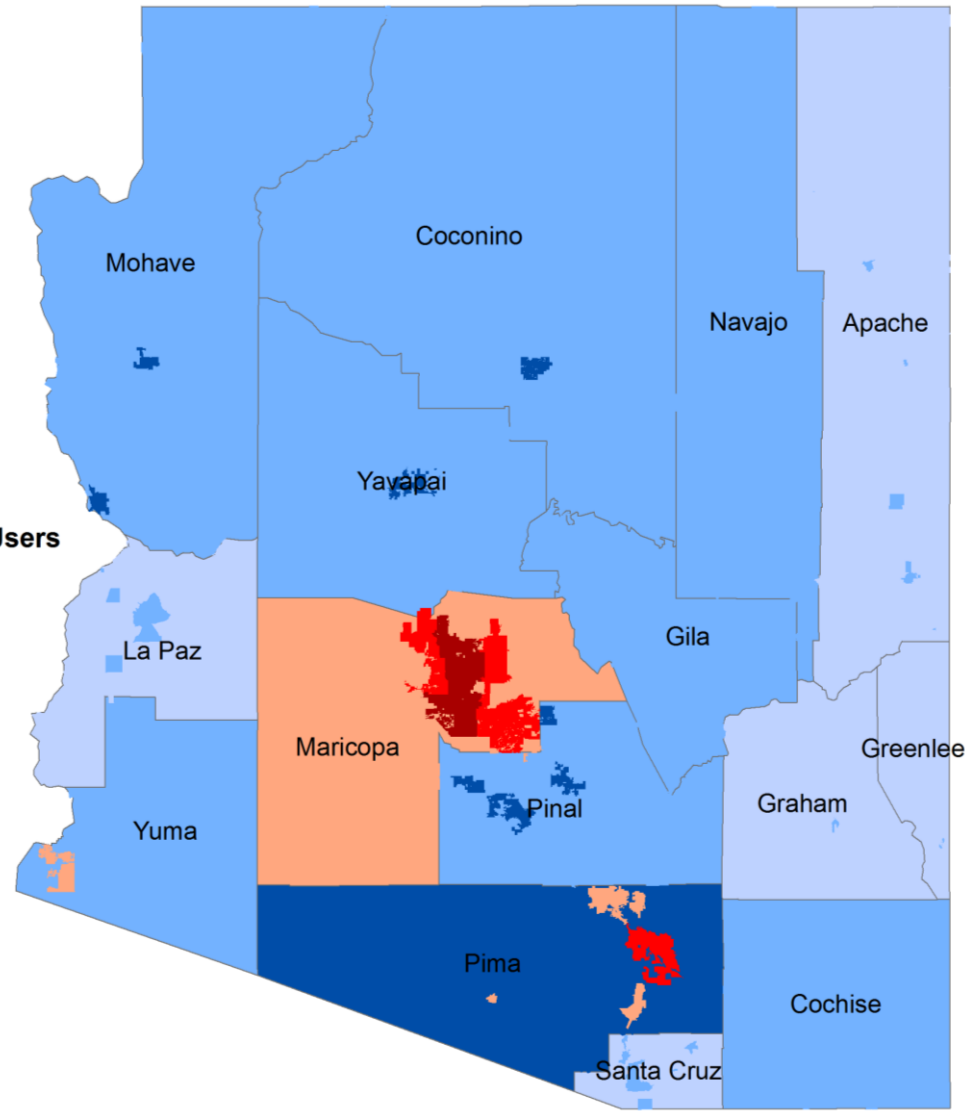
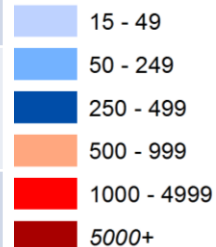


# Public Safety Population (Sworn Personnel)

Agency Type	Total Agencies	Total Sworn
Police (Local Law Enforcement)	80	8,342
Sheriff (County Law Enforcement)	15	2,060
State Police (State Law Enforcement)	1	1,052
Fire Departments (All/Most Career)	136	8,462
Fire Departments (All/Most Volunteer)	106	1,612
Emergency Medical Services (partial)	3	111
<b>TOTAL</b>	<b>341</b>	<b>21,729</b>

## Legend

### All Public Safety Users

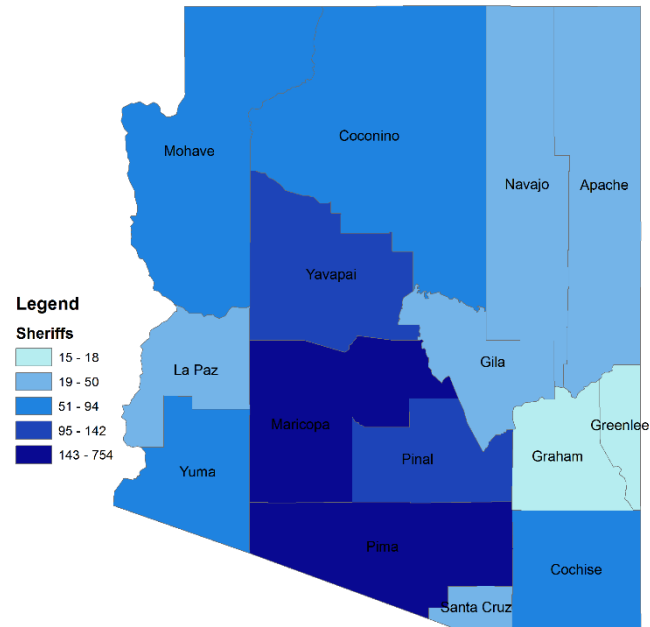


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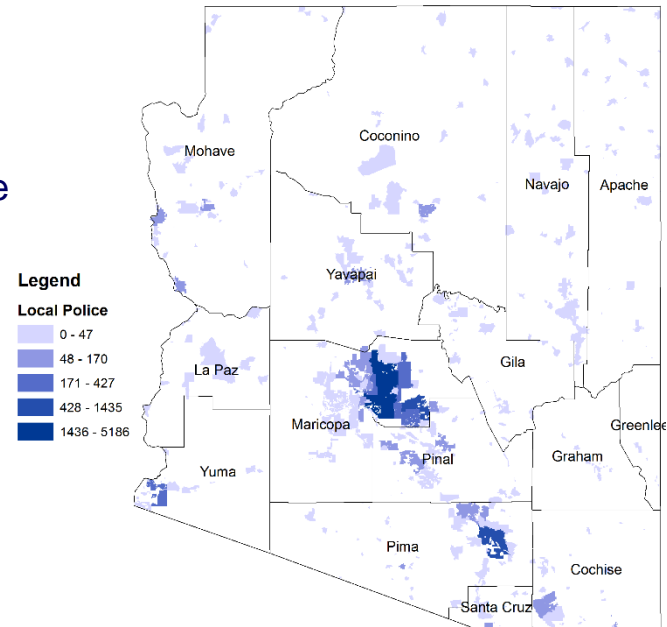
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# Public Safety Users

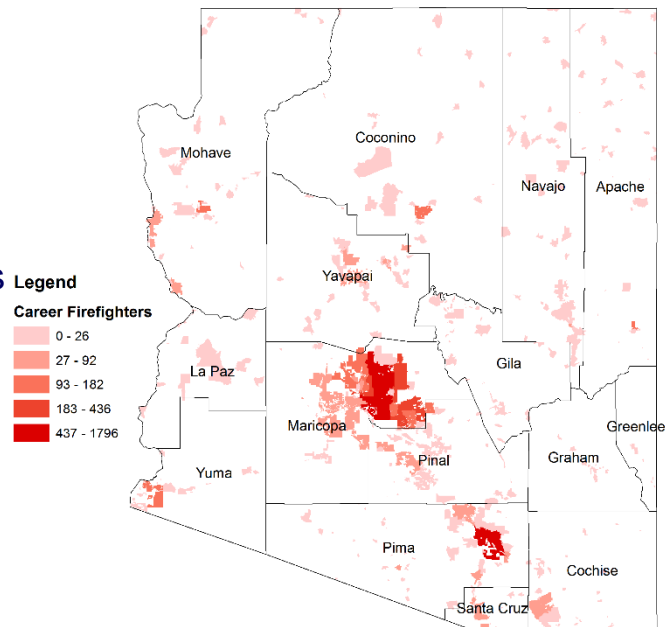
Sheriffs



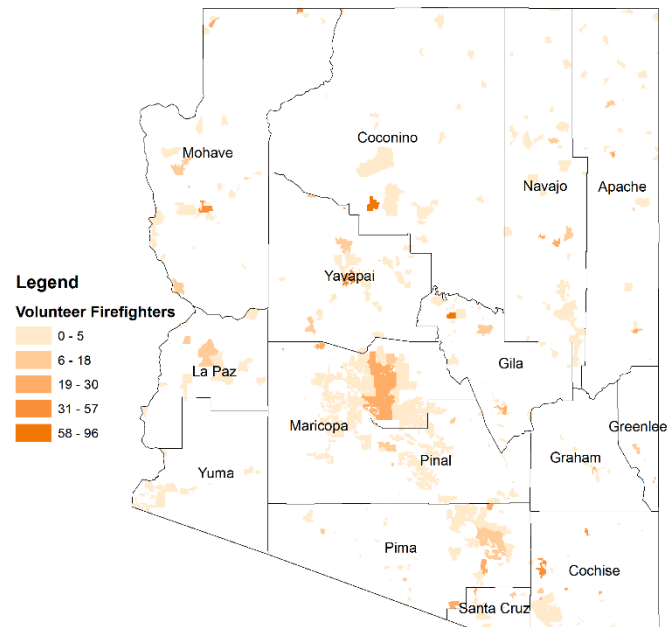
Local Police



Career Firefighters



Volunteer Firefighters



# Summary Table of Users

Sources: CASM, DOJ, FEMA and Commercial

Agency Type / Discipline	Agency Count	# of Personnel	# of Devices (non-LMR)
<b>Emergency Medical Services (EMS)</b>	3	111	
<b>Fire Services</b> (Career and Volunteer)	242	10,074	
<b>Law Enforcement</b> (Municipal Police, State Police, Highway Patrol, etc.)	96	11,544	
<b>Courts, Corrections and Security</b>	101		
<b>Education Establishments</b>			
<b>Emergency Management</b>	15		
<b>Facilities and Land Management</b>			
<b>Highway and DOT</b>	2		
<b>Hospitals and Medical Facilities</b>			
<b>Military/National Guard</b>	8		
<b>National Security/Intelligence</b>			
<b>Public Administration and Support Services</b>			
<b>Public Health</b>			
<b>Public Safety Communications</b>	77		
<b>Specialized Law Enforcement</b> (Intelligence, Dignitary Protection, etc.)	50		
<b>Transportation Operations</b> (Air, Pipeline, Rail, Sea, Waterway)			
<b>Utilities</b> (Electricity, Gas, Water, Telecom and Sewer)			
<b>Other</b>			
<b>TOTAL</b>			

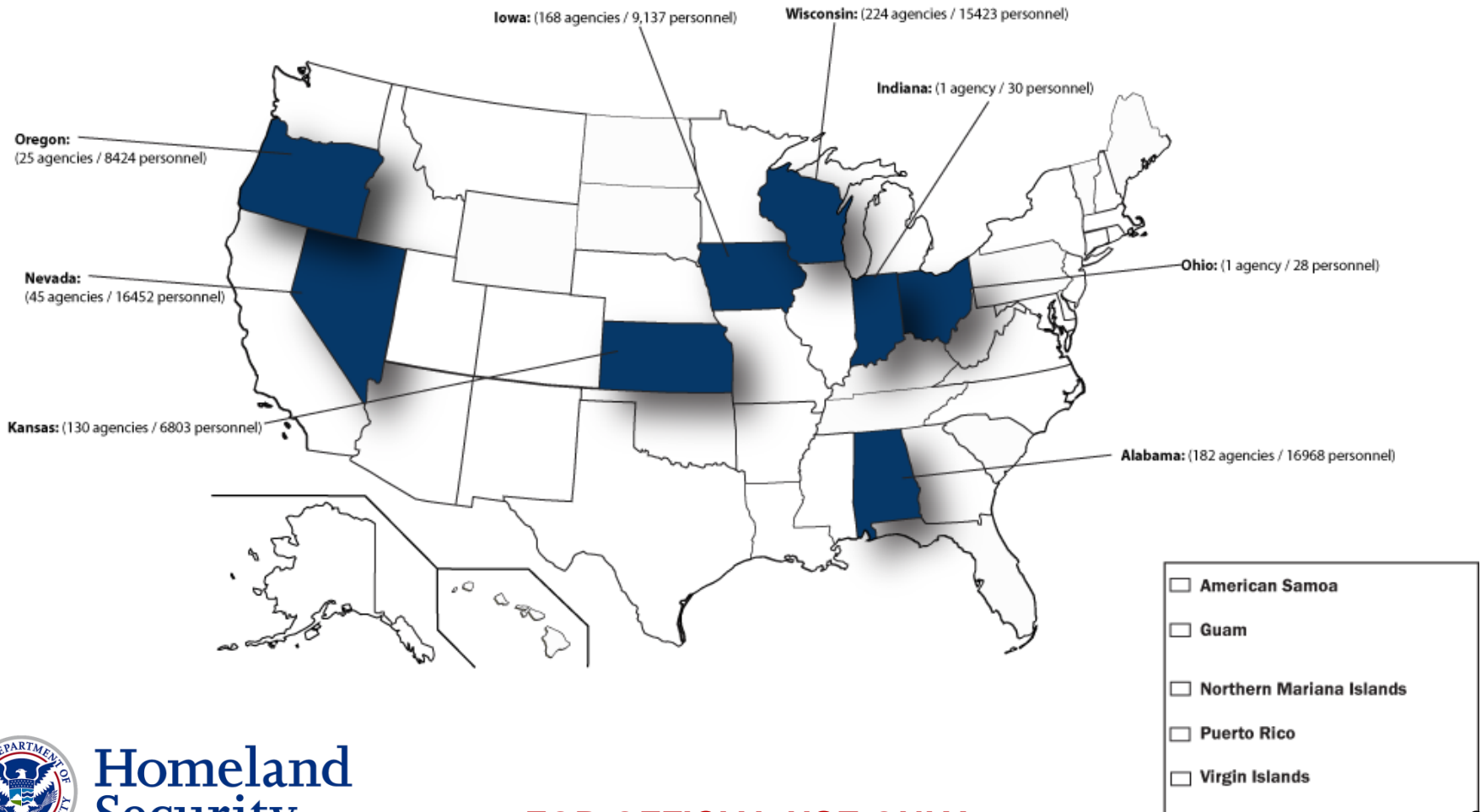


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# National Mobile Data Survey Results

- 8 States Represented
- 776 Survey Responses
- 73,265 Agency Personnel Responses
- Collection Period from Aug 2012 – May 2013



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# Public Safety Tools Website

**ICTAP**  
Interoperable Communications Technical Assistance Program

**Public Safety Technical Assistance Tools**  
Welcome to the Public Safety Technical Assistance Tools Website

Home | Tools | Resources | Training | PSToolsHelp | What's New (as of 12/09/2013)

Tools	Resources	Training
<b>FMT</b> Frequency Mapping Tool	<b>NIFOG Info</b> National Interop. Field Operations Guide	<b>Gateways</b> Audio Gateway Training Materials & CBT
<b>MDST</b> Mobile Data Survey Tool	<b>AUXFOG</b> Aux. Communications Field Operations Guide	<b>COMU</b> Communications Unit Overview Training
<b>NLST</b> Narrowband License Status Tool	<b>NPSBN</b> Nationwide Public Safety Broadband Network	<b>AUXCOMM</b> Aux. Communications Overview Training
<b>NSTT</b> Narrowband SummaryTracker Tool	<b>OEC Docs.</b> Office of Emergency Communications	<b>Proj. Mgmt.</b> Project Management Overview Training
<b>PS Library</b> Public Safety Library	<b>TA Request</b> Technical Assistance Catalog, Request & Evaluation Forms	<b>Radio 101</b> Basic LMR Overview Presentation
<b>CASM NextGen</b> Communication Assets Survey & Mapping Next Generation	<b>FCC Src.</b> Federal Communications Commission	<b>Tribal Outreach</b> Engaging Tribal Governments Overview Presentation

Controlled Access: [\\* How do I get Access?](#)

**RLCT**  
Response Level Communications Tool

**www.publicsafetytools.info**



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# MDST Example Questions

**1. Agency Info:** Name, Discipline, Location, Contact info

**2. Commercial Systems:** Provider, Cost, Devices, Contracts

**3. Private Systems:** Provider, Cost, Radios

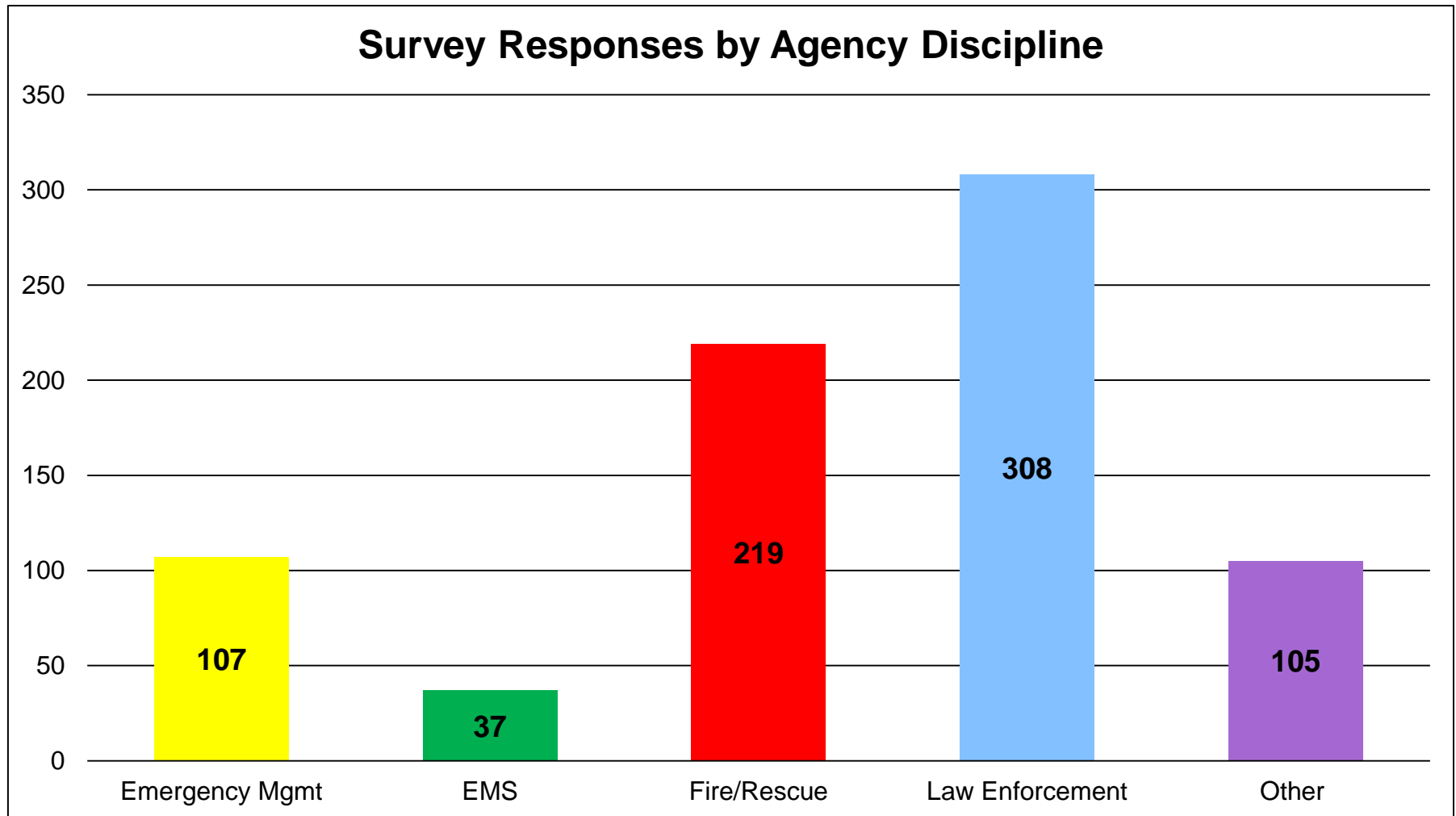
**4. Wireless Services:** Barriers, Personal Use, Coverage

**5. NPSBN Info:** Awareness, Applications, Potential Assets, MOAs

**6. LMR:** Radio counts, cost, end of life



# National Mobile Data Survey Results

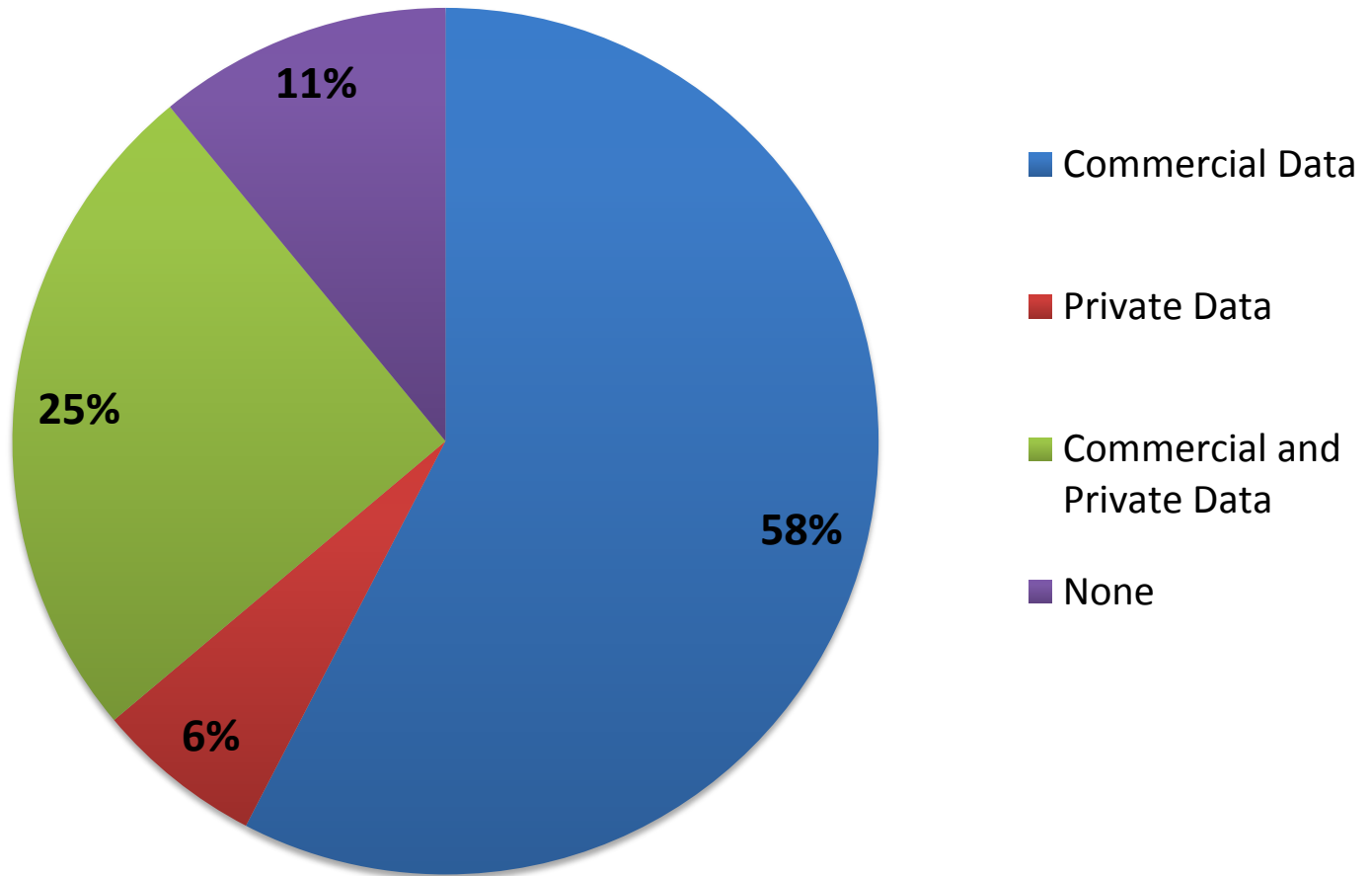


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# National Mobile Data Survey Results

## Wireless Data Systems (All Agencies)

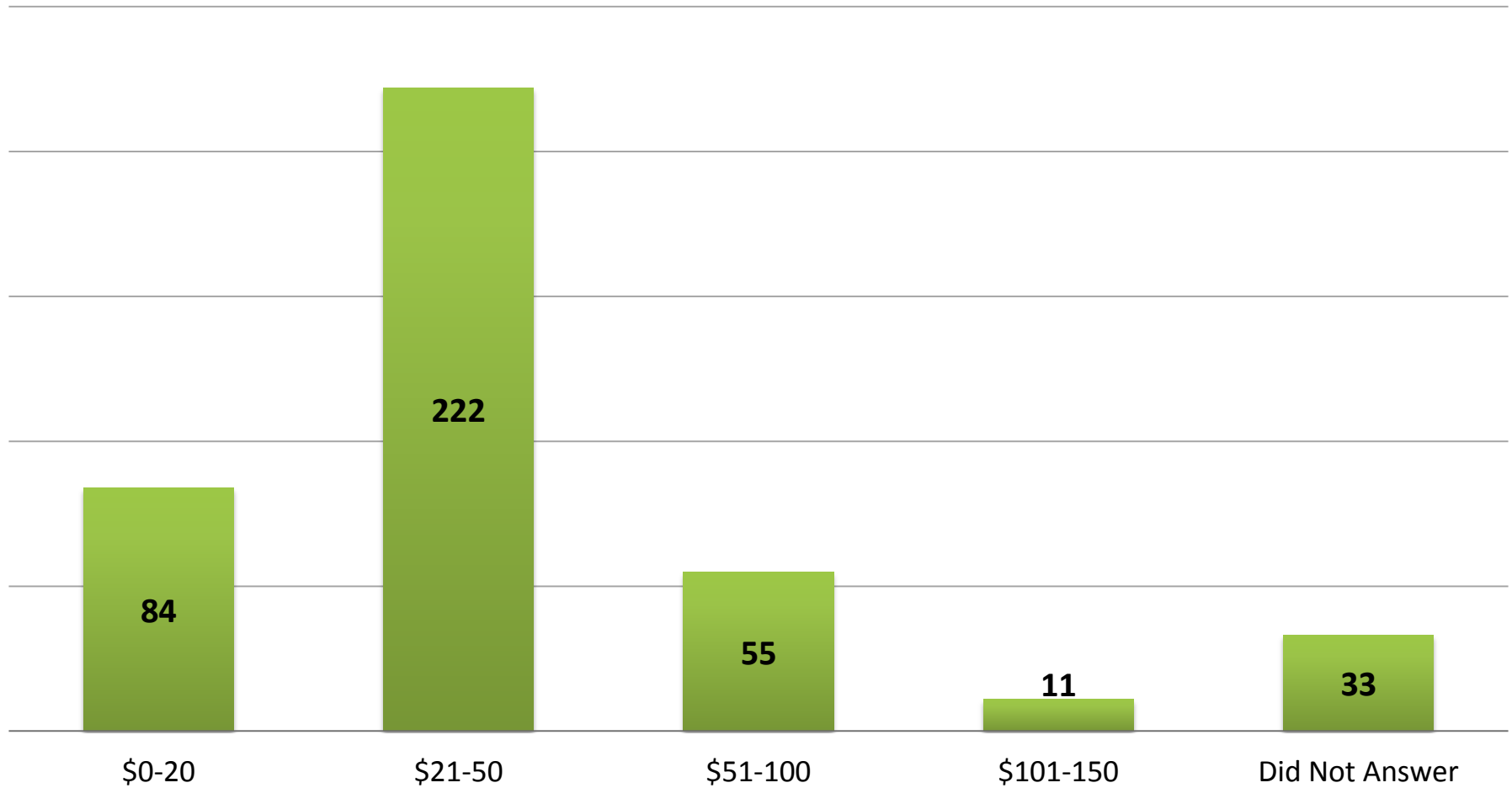


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# National Mobile Data Survey Results

## Average Monthly Device Costs for Commercial Systems

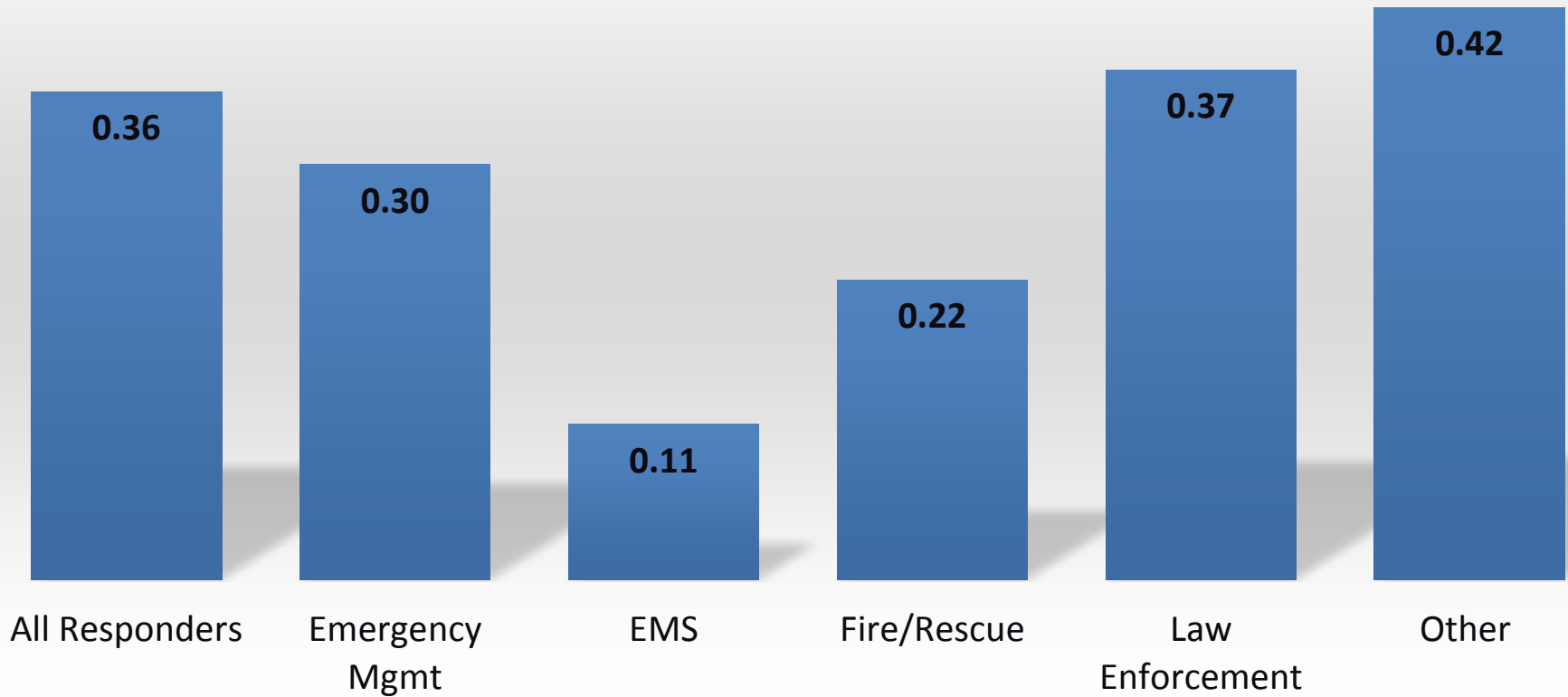


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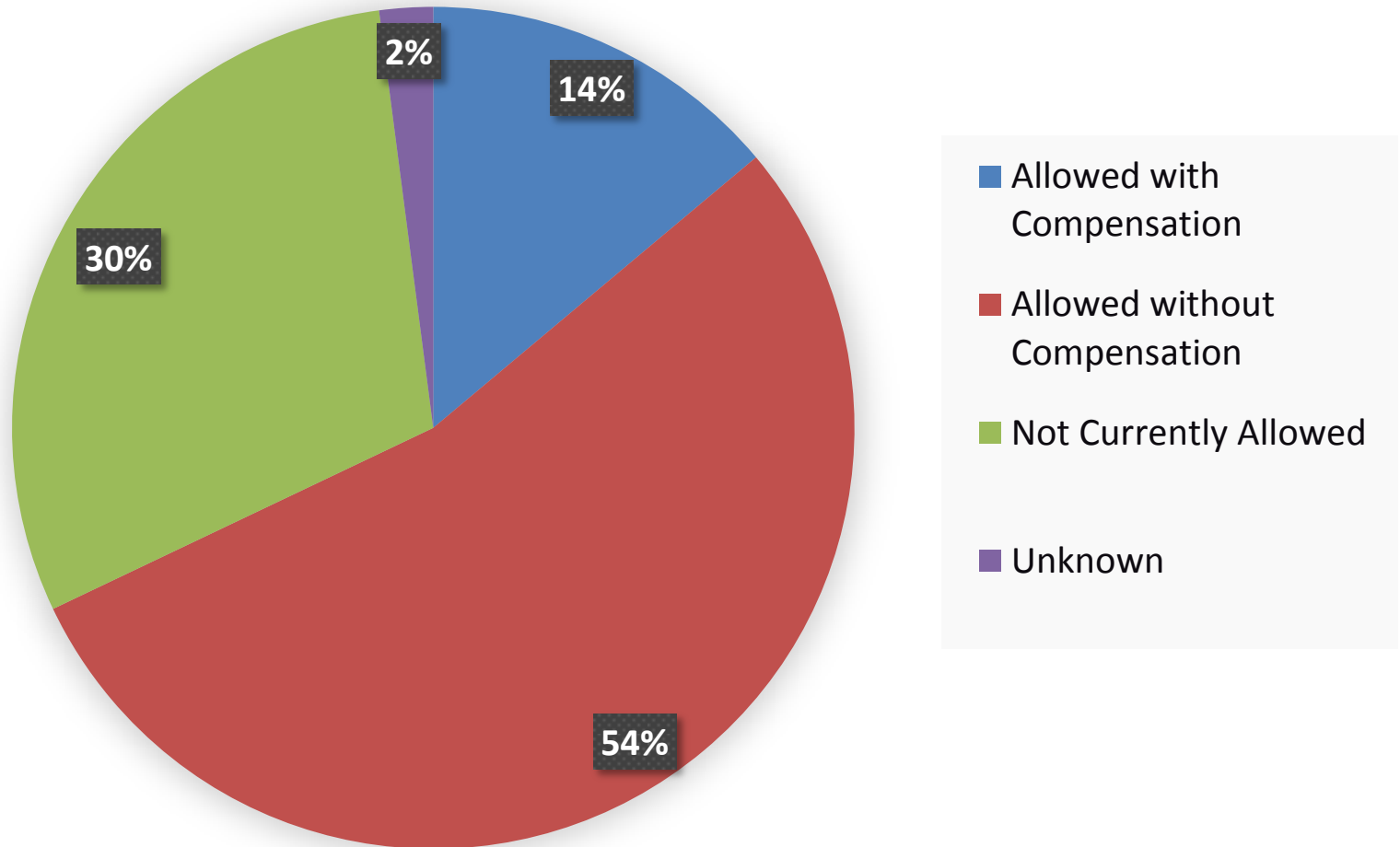
# National Mobile Data Survey Results

**Average Number of Wireless Data Devices per Responder  
(does not include LMR)**



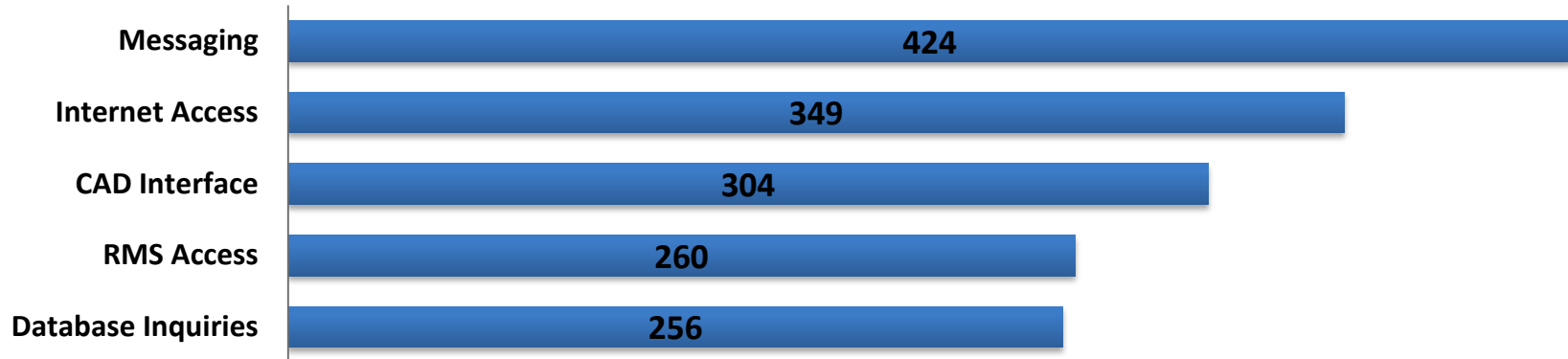
# National Mobile Data Survey Results

## Use of Personal Devices (All Agencies)

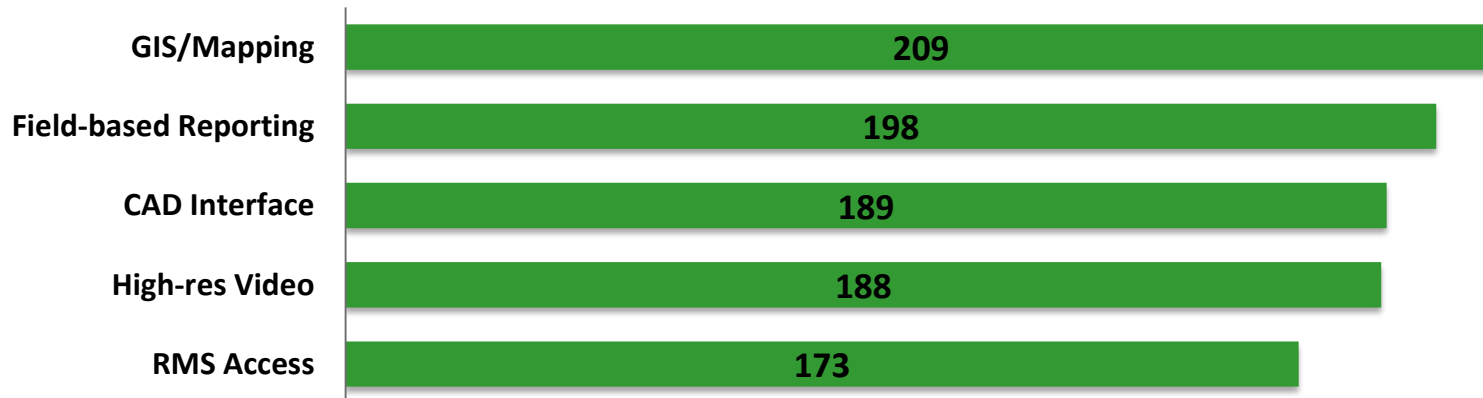


# National Mobile Data Survey Results

## Top Current Applications



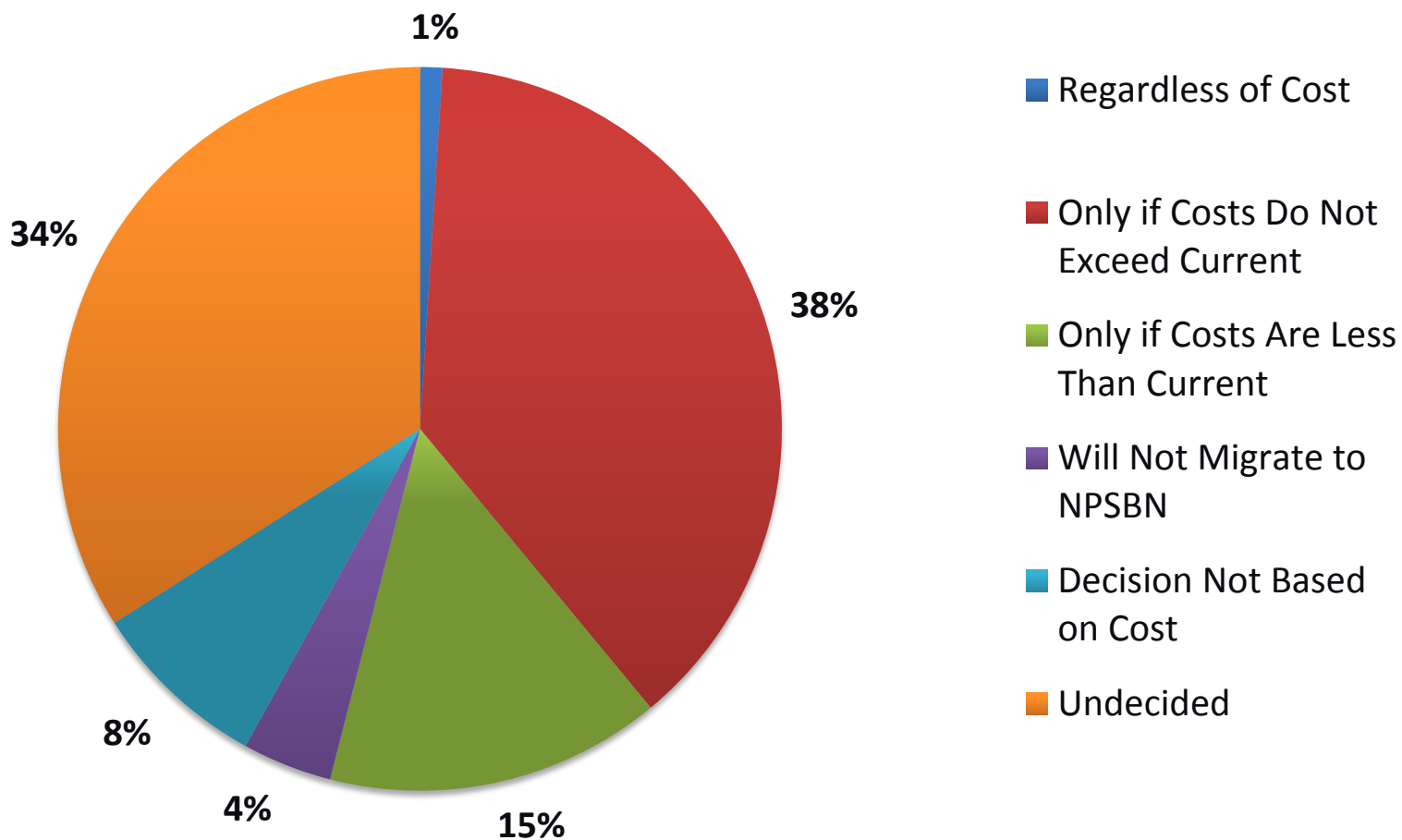
## Top Desired Applications





# National Mobile Data Survey Results

## Cost as a Factor in Decision to Migrate to NPSBN



# Workshop Summary

- **OEC and tools available to public safety agencies**
  - Mobile Data Survey Tool
  - Broadband Resources
- **High level overview of LTE and NPSBN**
- **FirstNet and SLIGP grant overview**
  - FirstNet consultation information
- **Coverage Objectives**
  - States can start identifying Required Coverage levels to Prepare for FirstNet Consultation
  - OEC will provide all materials electronically including map GIS data for continued use
- **User Identification**
  - States can start identifying potential users to prepare for FirstNet Consultation



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